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How effective is innovation support for SMEs? An analysis of the region of Upper Austria

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Abstract

SMEs are confronted with particular problems constraining their innovation activities. How their needs are fulfilled by support instruments has been investigated in a recent European research project. The results for the region of Upper Austria lead to the conclusion that some of the support is mistargeted, disregarding certain indicated or latent deficiencies of SMEs: direct financial support concentrates on research and development, neglecting the commercialization of innovations. In general, high-technology innovation projects are preferred, less technologically advanced or innovative firms lack adequate support. The spillover effects of technology centres are limited. The problem that most SMEs hardly interact with knowledge providers from outside the business sector (e.g., universities) is not reduced by the support instruments. Furthermore, they perform insufficiently the function of interfaces to innovation-related resources and information from outside the region. There is a lack of proactive consultancy concerning strategic, organizational, and technological weaknesses which is necessary because often the firms are not aware of such deficiencies.

Keywords: SME; Innovation support instrument; Upper Austria

1. Introduction

Innovation is one of the most important strategies of competition, both for small and large firms. It is often argued that SMEs innovate in specific ways, different from the innovation process in large firms. While there are certain size-specific features, the heterogeneity of the SME sector prevents simple generalizations. Regarding innovative performance, the heterogeneity is caused by a mix of factors. The most important are:

- *The technological level*. Higher-technology and "technology-driven" (Hassink, 1996) firms are more active in product innovation, especially as far as products which are new to the market are concerned. Lower-technology firms, on the contrary, focus more on process innovations and cost reduction.
- *The market relations*. The more dependent a firm is on dominant customers, the more likely is the incremental character of their innovation activities. Most clients tend to stick to already known solutions and applications and are hardly willing to assess unfamiliar innovations (von Hippel, 1988).
- *The strategies of competition*. Competition through improved quality and new functions favours innovation whereas price competition is less stimulating (Smallbone et al., 2000). Competition based on design leads to frequent product innovations, but they are usually incremental.

This heterogeneity is one of the reasons why there are contradictory results comparing the levels of innovativeness between SMEs and large firms. Some studies have found evidence that SMEs are generally more innovative (Pavitt et al., 1987; Acs and Audretsch, 1990), whereas according to other studies large firms appeared to be more innovative (Community Innovation Survey, 1997/98; Craggs and Jones, 1998; Kaufmann and Tödtling, 1999). The ongoing process of globalization,

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however, raises the importance of innovation in the whole SME sector, because it makes it possible for competition to invade formerly safe market niches (Malecki and Tödtling, 1995; Smallbone et al., 2000).

The region is especially important in the innovation process of SMEs. Their external relations are more confined to the region than those of large firms, a finding which has also been identified by the REGIS project (Cooke et al., 2000) and other research efforts (Sternberg, 2000; Fritsch et al., 1998). The region is a highly relevant support space for the innovation process of firms because of the necessity to have face-to-face interaction to exchange tacit knowledge and to collaborate in joint innovation projects. Another advantage of proximity is the spatially limited mobility of workforce and graduates from schools, both very important mechanisms of knowledge transfer to firms. While these are general arguments in favour of the regional level of innovation networks, there are specific features of SMEs which make the region comparatively more important for them than for large firms. SMEs are usually less capable of searching for and using codified knowledge (scientific in particular) which forces them to rely more on personal ways of transferring this knowledge and on learning-by-doing and -interacting. Furthermore, it is more difficult for them to apply formal contracts, relying more on trust-based, informal relations instead. The exact nature of a region's support for the innovation process of firms depends on the respective institutional setting (e.g., universities and other research organizations, vocational training institutions, technology centres and transfer agencies) and the structure of the regional economy (dominant industries, availability of service firms and adequate suppliers, organizations providing innovation finance). The heterogeneity of the SME sector makes it very difficult to target innovation support for SMEs in a way that they match the specific problems and needs of very different firms. Through a regional innovation policy innovation support could be designed to specifically target the particular needs of firms in the respective region.

Data from a research project — SME Policy and the Regional Dimension of Innovation (SMEPOL, see acknowledgements) — enable us to assess better if SME innovation support targets the real problems of the firms as well as the right firms, i.e., those SMEs which need support most or have the potential for the largest improvement in innovativeness. The research objectives of the SMEPOL project were to evaluate instruments supporting innovation in the SME sector[1] of certain European regions — the North and South-East of Norway, Upper Austria, central Denmark, Lombardy and Apulia in Italy, Limburg in The Netherlands, Wallonia, the region of Valencia, and the Lee Valley region of London and the adjacent outer metropolitan area. For each region, effects, strengths, and weaknesses of selected instruments — both regional instruments as well as the regional effects of national instruments — were investigated in order to deduce good-practice policy lessons for regional SME-innovation support. Within the SMEPOL project a broad range of support instruments in very diverse and specific regional settings in eight European countries were analysed. In this article we will deal with one case in detail — the region of Upper Austria.

2. The study region

The Austrian region which has been investigated in the SMEPOL project is the province of Upper Austria, one of the nine provinces (*"Bundesländer"*) of the Austrian state. The region borders on Germany and the Czech Republic, its population is 1.4 million. Formally the province has a wide range of competences for economic policy. In fact, however, the room for autonomous political activities is constrained by the small financial capacity compared with the state of Austria. Upper Austria has an industrial core region formed by the three cities of Linz (the capital of the province), Wels, and Steyr. Outside this core area there are peripheral areas in the north and south of Upper Austria but also several smaller industrial centres. The province has a long manufacturing tradition based on metal/steel-products and machinery. These industries are still very important, but today, the industrial structure is more diversified, comprising also transport, mining, and chemicals. During the Second World War, Germany had established large metal-and-steel and chemical plants for military needs. After the war they were extended to vertically integrated manufacturing entities which were huge for Austrian standards. These state-owned companies had an important function in the Austrian deficit-spending policy to fight recession after 1973. Employment was the more important objective than competitiveness. Due to labour hoarding the nationalized companies' productivity decreased strongly. At the end of the 1980s the structural weaknesses resulted in a serious crisis of the nationalized sector. Finally, the conglomerates had to be split up and privatized, some parts were sold to foreign companies. Firms were downsized strongly and, as a consequence, employment decreased significantly leading to serious labour market problems in the early 1990s. Overall, the recovery after the crisis has been successful, but the metal-and-steel sector and, as a result, the whole manufacturing sector is smaller today. Despite the process of restructuring, Upper Austria has been and is still one of the most important industrial areas in Austria (Lackinger, 1997).

[1] "SME" is defined as a firm with less than 250 employees and no participation of a larger company accounting for more than 25%.

The regional government of Upper Austria is very active regarding industrial, technology, and innovation policy. There is a special organization responsible for technology policy and investment marketing in the region, the Technology and Marketing Corporation in Linz. It has formulated a strategic concept for the technology policy in Upper Austria focusing in particular on strengthening applied R&D, intensified collaboration in clusters (metal and steel, machinery, vehicles), and improving technology transfer (Oberösterreichische Technologie- und Marketinggesellschaft, 1998). The province and certain municipalities try to support the technology- and innovation-infrastructure in Upper Austria, in particular concentrating on technology centres and technical colleges. The most important institutions in the so-called Upper Austrian Technology Network are the six technology centres. Most of them are incubation centres or business parks. Only two centres are also engaged in research. Another element of the technology- and innovation-related system are the recently established three technical colleges (*"Fachhochschulen"*). But the network also has weak points. The regional university, located in Linz, is relatively small compared to the major university locations in Austria, Vienna and Graz, and it is not specialized in technology. There are also no major contract research organizations as in other parts of Austria. Other institutional deficiencies in the system concern technology transfer services and innovation management consultancy.

3. The innovation process of SMEs and typical problems

This chapter is a summary of typical features of the innovation process in SMEs, based on literature and some key results from the Austrian SMEPOL-survey (Kaufmann and Tödtling, 1999). Before we present the results of the data analysis, however, it is necessary to describe some technical details of the survey: the survey in Upper Austria, covering the manufacturing sector as well as producer services, was conducted in 1998. A total of 204 firms answered which corresponds to a response rate of 18%, 140 of them were classified as SMEs. The distribution of the size of firms (in terms of employment) within the sample of respondents corresponds approximately to the regional economy. As far as the industrial structure is concerned, the metal-and-steel industry and metal products are overrepresented while chemicals, textiles, and clothes are underrepresented in the sample.

Due to the heterogeneity of the SME sector it is impossible to produce an exhaustive list of innovation related needs which applies to all kinds of SMEs. However, there are some general aspects of the innovation process which are valid for most SMEs, because they are directly or indirectly size related.

3.1. Resources and strategies of innovation

SMEs innovate with higher resource intensity than large firms, especially regarding human resources. In Upper Austria the average innovation budget in relation to turnover is 11.0%, the average innovation staff in relation to employment is 15.6% in the case of SMEs. Large firms, for comparison, have average ratios of 10.3% and 8.3%, respectively. SMEs usually cannot be organized in a way which allows them to benefit from specialization to the same extent as larger firms. This is an important disadvantage of small firms, because they are particularly confronted with a limited resource base anyway, regarding capital as well as time and know-how of the employees.

SMEs are less often engaged in research than large firms. In Upper Austria, research is performed by only 12.9% of the SMEs compared to 31.3% of the large firms. Of course, there are highly research-intensive SMEs, but in general, SMEs are confronted with serious size-specific barriers restricting the potential to do research: lack of financial resources, a small product range restricting the possibility to substitute for the lack of sales and profits through other products ("cash cows") to the same extent as large firms, too few or insufficiently qualified personnel, lack of time of the key persons who are preoccupied with day-to-day work, difficulties in adopting high technology, a lack of advanced technical know-how, and limited search capabilities, especially as far as scientific knowledge is concerned.

SMEs are less able to shape and influence the external environment than large firms (Smallbone et al., 2000). One of the consequences — as far as established firms are concerned, not start-ups — is a tendency to innovate in a reactive or defensive way. Customers, in particular, play an important role in guiding the innovation activities of their suppliers (von Hippel, 1988). Depending on the clients' wishes and specifications makes it difficult to go beyond incremental innovation, however. In Upper Austria the most frequent innovation strategies are specialization on niches and improving quality (Table 1). Due to the limited resources and marketing capacities it is, of course, more difficult for SMEs to try to enter into or open up new markets than for large firms. Within the

Table 1
Innovation strategies[a]

	% of SMEs	% of large firms
Diversification into new markets	18.6	23.4
Quality improvement	52.1	43.8
Specialization on a market niche	58.6	53.1
Cost reduction, productivity increase	42.1	67.2

[a] Source: SMEPOL-survey Upper Austria.

SME sector, only in the case of firms engaged in research is the offensive strategy of diversification more frequent. The differences between other types of SMEs are negligible in this respect.

3.2. External relations in the innovation process

It is quite frequent for firms — SMEs as well as large firms — to have external relations with business organizations contributing to their innovation activities. The data presented in Table 2 correspond to the results of other studies (e.g., Fritsch and Lukas, 1997; Sternberg, 1998; Kaufmann and Tödtling, 2000a) showing that the innovation relationships of firms are predominantly within the business sector, customers and suppliers being most important, less service firms and horizontal relations. A limited number of durable and selective user–producer relationships are usually shaping and restricting most of the product innovation activities of firms — especially small firms — because any change is costly implying the loss of accumulated informational capital (Lundvall, 1992). Furthermore, customers are often unwilling or not ready to assess unfamiliar innovations or to formulate an explicit need for them (von Hippel, 1988), which also restricts the ability of the suppliers to engage in more radical innovation projects. While SMEs are hardly less active than large firms as far as interactions within the business sector are concerned, there is a far more significant difference regarding knowledge providers, both from science and technology. SMEs are rarely interacting with universities, contract research organizations, technology centres, and training institutions (see also Cooke et al., 2000). Even if one considers that large firms too are not often interacting with these institutions, this is a specifically serious weakness of the SME sector. Without relations beyond the business sector, information and knowledge tends to be restricted to the well-known market leading to dependency either on strong business partners — usually dominant customers — or small markets for specialized products or services, without being able to substitute for other products if this market crumbles. A statistical analysis of data from a survey on innovation systems in several European regions (Kaufmann and Tödtling, 2000b) leads to the conclusion that it is particularly the interaction with science that stimulates more advanced innovation, i.e., products which are new to the market and not only imitations or modifications. Of course, there are differences between types of SMEs in this respect. The technological level of a firm is one of the most decisive characteristics distinguishing between different levels of willingness or the ability to cooperate (Keeble et al., 1997). In Upper Austria the most active SMEs regarding innovation cooperation with science partners are high-technology firms, firms engaged in research, and firms applying relatively more resources (funds as well as manpower) to innovation activities than the average.

However, it is not only the lack of relations with innovation partners from science and technology which constrains positive external influences on the innovation process of firms, this can also be due to the character of the relations. Only few of them are cooperative relations in joint innovation projects with intensive collaboration and information exchange according to shared objectives. The frequency of "real" cooperations with science institutions in particular is negligible (Table 2). A study on innovation cooperations in certain German regions (Fritsch and Lukas, 1997) contains some evidence that joint R&D projects might have become more important today — it was found that R&D cooperations were more frequent than research contracts — but nevertheless, the most frequent form of relation between industry and science was still the use of equipment and laboratories (without further interaction). This is a serious weakness, if one recognizes the importance of the exchange and joint creation of knowledge in industry–science cooperations for the stimulation of innovation, especially in the early phases of an innovation process when new ideas are created and new concepts developed (Fritsch and Schwirten, 1998).

Table 2
External relations in the innovation process[a]

	% of SMEs having		% of large firms having	
	any kind of relations	cooperations	any kind of relations	cooperations
Customers	78.6	48.6	87.5	53.1
Suppliers	60.7	40.7	79.7	39.1
Other firms (horizontal relations)	27.1	10.0	37.5	15.6
Service firms	34.3	15.0	46.9	20.3
Universities	27.9	7.9	71.9	37.5
Other research organizations	14.3	5.7	46.9	21.9
Technology centres	13.6	5.7	39.1	14.1
Training institutions	15.7	5.0	35.9	12.5

[a] Source: SMEPOL-survey Upper Austria.

An important reason for the lack of relations with innovation partners outside the business sector is the small number of employees in SMEs who are able to act as nodes establishing and maintaining links to innovation networks. This restricts the potential to search for and collect innovation-related information and to collaborate in cooperative innovation projects. There is a lack of experienced employees as well as a lack of time in the case of the few adequately qualified persons due to routine and administrative work. Market research, for example, is very rare in Upper Austrian SMEs (17%). Therefore, the danger of a "lock-in" is greater in the case of SMEs than large firms. Large firms, on the contrary, can establish and maintain relations to a broader range of sources of information and cooperation partners. In Upper Austria large firms are particularly more often engaged in innovation cooperations outside the region, in Austria as well as abroad, and with partners from science and technology.

SMEs focus more on the region than large firms as far as external relations in the innovation process are concerned. In Upper Austria this applies primarily to the firms' business relations — customers, suppliers, and horizontal relations — whereas in the case of service firms and technology centres the large firms, too, rely more on regional institutions. Only universities are more important on the national level, because the most important universities are located outside Upper Austria. A too dominant focus on the region limits the scope of available technical information, technologies, and accessible markets. In Upper Austria the region-centred view is particularly pronounced in the case of traditional industries and the service sector. There is also the problem of a lack of adequate innovation partners to cooperate with due to the limited scope of the region. In Upper Austria this is one of the most frequent reasons of SMEs not to cooperate. Of course, there are exceptions to the modest networking activity like highly specialized technologically advanced SMEs which are small as well as export-oriented and embedded into international networks. Technology intensive firms are usually more involved in innovation networks, both on local and international levels (Keeble et al., 1997).

Personal face-to-face interaction is important in the innovation process due to the role of tacit knowledge in addition to more easily transferable codified knowledge (Lundvall and Borrás, 1998), the fact that many innovation-related interdependencies cannot be traded (Storper 1995, 1997), and the necessity of durable trust-based relations as a precondition to exchange valuable knowledge (De Bresson and Walker, 1991; Cooke and Morgan, 1993). The advantages of proximity and institutional settings specifically adequate to serve the needs of the regional economy are the reasons why the region is an important spatial level in innovation systems (Braczyk et al., 1998; Cooke et al., 2000). However, the close interaction in local production systems (Garofoli, 1991; Pyke and Sengenberger, 1992; Asheim, 1996), innovative milieux (Aydalot and Keeble, 1988; Maillat, 1991), or high tech regions (Saxenian, 1994; Castells and Hall, 1994; Tödtling, 1994) can also lead to negative consequences. The structure of innovation networks can become rigid, long established routines in innovation processes can restrict more innovative or radical product development activities. Such a "lock-in" situation can only be avoided if companies have a well-developed absorptive capacity regarding external research results and if they maintain flexible interaction ("weak ties") with a wide range of innovation partners (Granovetter, 1973; Grabher, 1993; Meyer-Krahmer and Schmoch, 1998). Involvement in distant networks is important for any innovative milieu to avoid paralysis (Camagni, 1991).

3.3. Innovation barriers

The most frequently indicated barriers constraining innovation are financial — lack of funds for innovation, too high risk of innovation projects, too expensive technology. This applies both to SMEs and large firms. Manpower is the second most frequent bottleneck, either because adequately qualified personnel are missing or there is a lack of time available for innovation activities. This kind of problem is slightly more frequent in the SME sector. In contrast, technological barriers like insufficient technical know-how or unavailable technology seem to be less important (Table 3). Types of problems and barriers constraining innovation are very different, depending on the type of SME. First, there are sector-specific conditions causing particular problems (e.g., personnel problems in the electrical equipment-and-electronics industry, lack of funds and dependency on clients in the case of producer services). Second, the smallest SMEs (with less than 10 employees) and those dedicating an above-the-average-share of their financial

Table 3
Problems constraining innovation activities[a]

	% of SMEs	% of large firms
Lack of funds	24.3	15.6
Too high risk	25.0	28.1
Lack of technical know-how	6.4	4.7
Inavailable or too expensive technology	12.1	14.1
Lack of qualified personnel	10.7	7.8
Lack of time	15.0	12.5
No need for innovation	5.0	12.5
Deficiencies in marketing or commercialization	7.1	4.7
Dominating external demands (clients)	7.1	3.1
Secrecy requirements of clients	4.3	3.1

[a] Source: SMEPOL-survey Upper Austria.

resources to innovation are especially confronted with financial constraints. Third, manpower bottlenecks seem to be most serious in the case of firms engaged in research. Finally, problems are in general more serious in the case of lower-technology than higher-technology firms.

The dominant role of the entrepreneur or the owner of a small firm can lead to a narrow strategic perspective, in particular when he/she lacks formal training or qualifications (Smallbone et al., 2000). Strategic deficiencies and organizational weaknesses of SMEs are of central importance constraining innovation. A related problem is the narrow focus of many SMEs on their customers, making their innovation process dependent on them. Frequently this is reinforced by the neglect of systematic search activities concerning new market opportunities. It is important not to neglect other types of problems than financial or technical which are constraining innovation. Often firms do not sufficiently recognize them. Insufficient awareness of deficiencies seems to concern primarily innovation partnerships, strategies, and market information and research. It is especially the value of cooperation for innovativeness which is underassessed by many SMEs. In Upper Austria the most frequent reason for SMEs not interacting is "no need". In addition, market research activities are rarely performed. The problem "lack of time" is usually better recognized. It was frequently indicated in the survey that the daily work-overload of very few persons or even a single person in SMEs impedes or delays innovation projects. It seems to be less often recognized, however, that organizational improvements could lead to an increase in the time available for innovation activities.

4. Support services offered by the investigated instruments

4.1. Regional technology centres

From the six technology centres in Upper Austria two are research-oriented — Software Park Hagenberg (SWP) and Research and Training Centre for Labour and Technology Steyr (FAZAT). The other four — Incubation and Technology Centre Wels, Technology Centre Linz, Technology Centre Innviertel in Braunau, Technology Centre Salzkammergut in Lenzing — are mainly incubation centres and business parks.

The technology centre which is most explicitly R&D-oriented is the *Software Park Hagenberg* (SWP), located close to the capital of Linz. It is a technology and research centre for software development, industrial mathematics, and related services, exclusively focusing on this technology field. The SWP was founded in 1987, initiated by a department of the University of Linz (Research Institute for Symbolic Computation). It soon expanded, attracting firms to this location. Today the centre comprises three types of institutions — university departments, a technical college, and firms. Accordingly, the innovation-related activities cover research, higher education and training, and applied industrial development. Research is primarily done by the three departments of the University of Linz which are partly located in Hagenberg, teaching by the technical college (offering the courses Media Engineering and Media Design and Software Engineering), and industrial development projects by the firms. The 27 companies in the park are predominantly very small. Most of them have up to three employees, some are even only one-person firms. Most of the firms are spin-offs of former research projects. Besides these small companies there are two research laboratories of major Austrian electronics companies located in the park. The most important source of income is contract research and development. Higher education receives federal funds, but additional subsidies are rare. Currently, there are approximately 100 persons working in the park. This number comprises both the employees of the firms and the personnel of the research institutes. The technical college has about 300 students. Networking between scientific institutes, research laboratories, firms, and the technical college is an important organizational principle of the centre.

The *Research and Training Centre for Labour and Technology* (FAZAT) is located in one of the old industrial areas of Austria — in Steyr. During the 1980s the region of Steyr faced serious economic problems of industrial decline, partly caused by the crisis of a major Austrian company of the vehicles industry (Steyr-Daimler-Puch). One of the revival strategies for the region was the establishment of a technology centre in Steyr in 1989. The original plan of an incubation centre was soon extended to the more ambitious project of a technology centre including a technical college. Today the FAZAT hosts one of the four technical college courses in Upper Austria (Manufacturing and Management Technique, with about 80 students per year). The incubation centre, however, is rather small with only six firms, mainly active in automation and telematics. Mainly due to the scarce space at the location it is intended that R&D projects are hosted by the FAZAT until they are applicable or can be introduced into the market. Then the initiative has to be run as a separate organization and, after some time, should be relocated. There are also close links to science. In the field of process automation (especially robotics) the Institute for Flexible Automatization of the Technical University of Vienna has a contract research subsidiary in the FAZAT, employing 30 persons — engineers as well as scientists. For the establishment of the FAZAT most subsidies were provided by the municipality of Steyr. To a lesser extent the province of Upper Austria and federal ministries have provided subsidies. However, the public contri-

bution is continuously decreasing, reinforcing the importance of contract research and consulting as sources of funds.

In contrast to these R&D-oriented institutions the other four technology centres in Upper Austria concentrate on providing facilities to small firms and start-ups. They rarely perform additional functions like innovation consultancy or technical services. These centres are located in Linz (with 46 firms and organizations), Wels (39 firms), Braunau (28 firms), and Lenzing (seven firms). Most of the centres have been established only recently and are still in a phase of expansion. The firms located there are young (start-ups), usually very small (less than 10 employees), and belong predominantly to software, data processing, and consulting services. There are hardly any manufacturing companies and only a few high-tech firms. The R&D intensity is rather low. A general feature of all centres is the necessity of being self-supporting. The role of the public sector is very limited, subsidies are of little importance. The consequences are small staffs available for the centre management and market-oriented activities. Services or functions which are less profitable are not performed, which restricts the potential of these centres to support innovation activities of firms internal and external to the centre.

4.2. Direct financial innovation support

The *Austrian Industrial Research Promotion Fund* (Forschungsförderungsfonds für die gewerbliche Wirtschaft, FFF),[2] located in Vienna, supports research and development projects of firms. It concentrates on the early phases of the innovation process, i.e., research and development of prototypes. The FFF is an autonomous funding institution under the control of the Austrian Ministry for Economic Affairs. The executive board consists of representatives of the Austrian "social partners" (trade union, chamber of labour, chamber of commerce) and major Austrian companies.

Basically, the FFF pursues a bottom-up strategy which means that the firms themselves decide on the technologies and markets which are the basis for and the targets of their innovations. The FFF does not define formal technology focus areas. Nevertheless, the FFF is not indifferent with regard to technologies and levels of innovativeness. The actual support activity targets high-technology, very risky R&D projects, and more than incremental innovations. As far as SMEs and start-ups are concerned, projects which improve the technological level of these firms are significantly preferred. This leads to a situation where certain technological fields are predominant in receiving support. These fields are microelectronics and information technologies (21% of total funds and 16% of supported projects), pharmaceutical technologies (9% of funds and 2% of projects), and advanced materials (7% of funds as well as of projects). The Austrian industries most frequently benefiting from FFF support are machinery, information and communication technologies, data processing, medical, measurement and optical technologies, and chemicals. These are industries with a significant or even predominant share of high-technology firms. Overall, the technologically advanced sector has much more weight in the FFF scheme than in the Austrian economy. Accordingly, more mature industries like metal products, textiles, furniture and food can hardly benefit from FFF support. Small and medium-sized firms with less than 250 employees account for nearly 75% of the supported firms, but it has to be considered that this is clearly less than the share of SMEs in the Austrian economy. Furthermore, SMEs received only half of the funds provided by the FFF. Actually, SMEs are not the primary target of the FFF-support activities.

The FFF uses a mix of three instruments: non-repayable grants, loans with low interest rates, and guarantees. The favoured conditions of the loans comprise low interest rates (3% p.a.) and the abstention from securities. The average project support consists of 60% loans and 40% grants. The actual composition varies, depending on risk, technological advance, and economic situation of the firm. This means that a newly established firm pursuing a high-risk and technologically ambitious innovation project will receive a higher percentage of the support in the form of grants. In the past few years, guarantees have gained relative importance, the share of loans has decreased slightly, whereas the share of grants has remained rather constant.

The limit to what extent a project is going to be supported by the FFF is 50% of the project volume (the total costs of the R&D project). The other half has to be financed by the applicant himself. The projects are evaluated according to a fixed rating procedure applying technical (e.g., novelty, R&D risk, feasibility, functionality, technological up-grading) and economic (performance, marketing experience and perspectives, commercialization strategies) criteria with different weights. The criteria are not defined in a very detailed way, there is room for interpretation. The evaluation is done in-house, external experts are not involved. The decision to support a project and the extent of support has to be taken within 6–8 weeks, which is relatively fast. The primary evaluation might seem to be superficial therefore, but the FFF has two possibilities within 1 year to stop funding if the progress of the project is insufficient. One year is the maximum length of any project before a new evaluation has to be done in order to continue a longer-lasting project. The first half of the sup-

[2] All data regarding innovation support are based on the annual reports of the FFF (Forschungsförderungsfonds für die gewerbliche Wirtschaft, 1990–97).

port is paid at the beginning of the project, the second half when 50% of the total project volume has been spent. If a project fails in a technical respect, then it is possible to transform loans into grants. This is not possible in the case of a commercial failure.

In 1997 the FFF provided 169.1 million EURO for innovation project support — 58.8 million EURO as grants, 79.0 million EURO as loans, and 31.4 million EURO as guarantees. Projects accepted for support and funds provided have been continuously rising since 1994. The rate of project acceptance has been rather stable, around 75%. The average funds provided by the FFF per project have increased, especially since 1995 up to 180,000 EURO.

The share of Upper Austrian firms in receiving FFF support (23% of the projects as well as the funds) equals the share of Upper Austria's manufacturing sector in the national gross product of manufacturing (22%). Industries which benefit most from FFF support like machinery and chemicals are very important in Upper Austria.

The FFF is a well known institution in Austria, therefore the organization does not engage in the active acquisition of new applicants. Many companies have established a long-term relation to the FFF. Approximately half of the applicants per year had already been supported by the FFF before (the so-called "regular customers"). The other half consists of new applicants. The FFF has obviously established long-term links to some firms which are usually high-tech-oriented and innovate continuously. This reduces the capacity of the fund to act as a stimulator for new and additional innovation activities by firms which were not innovative at all in the past or want to increase the technological level of their innovation activities.

In the following chapter the results of the analysis of innovation support for SMEs in Upper Austria will be presented which point to some inadequacies of direct financial support and technology centres.

5. Types of mistargeted innovation support regarding SMEs

Under the term "mistargeting" we understand the problem of insufficient effectiveness of support activities due to the mismatch between support offered and needed or benefiting firms and firms needing support.

- Firstly, there can be a mismatch between the support offered and needed, i.e., the support instrument does not target the most serious problems constraining the innovation activities of SMEs. In this case the instrument is inefficient as far as the targeted problems are concerned, because the improvement of innovative capabilities would be higher if the instrument would concentrate on the more serious problems instead.
- Secondly, there can be a mismatch of firms which are targeted and firms which need support. In this case those problems which are the most important innovation barriers are correctly targeted, but not in the case of those SMEs where the problems are most serious or urgent or where the largest improvement in innovativeness can be induced. Such an instrument is inefficient as far as the targeted types of SMEs are concerned. In order to increase efficiency, support has to be reorientated towards firms where a stronger improvement of innovativeness can be expected. Usually these will be the less or not innovative SMEs. This form of mismatch is difficult to analyse, however, because it requires one to assess the expected improvements of innovative capabilities.

The aim of innovation support is to improve the innovative performance of firms. Innovative performance, however, cannot be improved directly, but only via providing certain inputs to the innovation process. Innovation inputs comprise a wide range of hard and soft factors, often including process and organizational innovations, which together enable a firm to succeed in product and service innovation. It is not only finance, technology, and technical know-how which matter, but also consultancy regarding marketing, innovation management, strategy formulation, and so on. As a consequence, it is often difficult to isolate the effects of support instruments from other factors contributing to a better innovative performance of a firm.

The results from the Upper Austrian SMEPOL investigation contain evidence for mistargeted innovation support. The most significant weaknesses will be described in this chapter.

Technology centres in Upper Austria are hardly used by external SMEs in the region. Mostly the services of the centres are used only by the firms which are located there. The centres confine themselves, intentionally or actually, to the function of incubators (see also Österreichisches Institut für Raumplanung, 1998). In addition, most firms located in the centres see them as facility providers and do not indicate further services supporting their innovation activities.

Table 4 shows that the use of technology centres is less frequent than the participation in direct support programmes. In particular, there are too few external clients of technology centres. According to the survey data the spillover effects to SMEs in the region are negligible. In comparison, relations to the centres are more frequent in the category of large firms.

How do the firms themselves assess the necessity of the received support for the realization of the respective innovation project? A significant number of Upper Austrian SMEs indicated that the received support was not required for this purpose (Table 5). This can be taken

Table 4
Frequency of firms having received certain types of innovation support[a]

	% of SMEs	% of large firms
FFF as well as other direct support programmes	35.7	67.2
FFF support only (no other direct support)	17.1	18.8
Technology centres in general	20.7	39.1
Upper Austrian technology centres	15.7	29.7
located in the regional centres	9.3	4.7
external, using regional centres' services	6.4	25.0

[a] Source: SMEPOL-survey Upper Austria.

as an indication of the innovation support schemes not targeting the most important needs of the SMEs.

Slightly more than half of the SMEs benefiting from direct financial support considered the received support to be absolutely necessary to realize their innovation projects. For almost as many firms the support was either only helpful (so that the project could achieve the intended scope or quality, but nevertheless, would have been finished without support too), or they would have been able to realize the project completely without support. Technology centres ore obviously more important in this respect. It is interesting that the more active innovators (SMEs with radical innovations and above than average innovation resources) more frequently assessed the support as necessary. On the contrary, more than one third of the SMEs engaged in research did not consider the support to be necessary at all. It seems to be that support is most relevant in the case of resource-intensive innovation processes, but not necessarily in the case of knowledge-intensive innovation projects.

If one looks at the support effects in detail, it appears that significant effects are clearly more frequent in the case of direct financial support than technology centres (Table 6).

According to the view of most SMEs financial support is effective. The most frequent positive effect concerns the co-funding of investments, followed by the co-funding of personnel. As far as the co-funding of external consulting services is concerned, however, the clear majority of SMEs did not think that the support improved their ability to innovate significantly. According to different support methods there are differences regarding the frequency of the effects. The FFF targets

Table 6
Significant support effects on the innovation process indicated by the SMEs[a]

	% of firms supported by		
	direct support in general	FFF support only	technology centres
Funding of investments	65.7	45.8	
Funding of personnel	50.7	54.2	
Funding of external consulting services	31.3	33.3	
Provision of technical know-how			18.2
Technical services			9.1
Provision of infrastructure			4.5

[a] Source: SMEPOL-survey Upper Austria.

Table 5
The SMEs' assessment of the necessity of innovation support[a]

	% of supported firms indicating support as		
	unnecessary[b]	supportive[c]	necessary[d]
SMEs with any form of direct support	16.7	30.3	53.0
SMEs with FFF support only	21.7	30.4	47.8
SMEs located in or using services of Upper Austrian technology centres	6.7	20.0	73.3
Radical innovators[e]	17.1	29.3	53.7
Incremental innovators[f]	16.0	40.0	44.0
SMEs engaged in research	36.4	18.2	45.5
Relative innovation budget>average[g]	0.0	38.5	61.5
Relative innovation manpower>average[h]	0.0	34.8	65.2

[a] Source: SMEPOL-survey Upper Austria.
[b] Full realization of the innovation project also without support.
[c] Realization of the innovation project in a reduced version.
[d] Realization of the innovation project without support impossible.
[e] Firms having introduced products which are new to the market.
[f] Firms having modified products or having introduced products which are new for the firm only.
[g] Ratio "innovation budget/turnover">11.0% (mean value of SMEs).
[h] Ratio "innovation staff/number of employees">15.6% (mean value of SMEs).

support more on personnel than other direct support schemes which aim more at investments.

In contrast to direct support, the effectiveness of technology centres seems to be far worse as far as the provision of technical know-how and technical services is concerned. Such services are either not provided or of little value for the firms. The provision of infrastructure seems to be taken for granted by firms located in the centres or they do not think that this has a positive influence on their innovation activities. That few firms with relations to technology centres indicated support effects seems to be a contradiction to the result that many firms assessed the centres as necessary to be able to realize certain innovation projects (Table 5). One has to concede that some firms obviously neglect or are unaware of certain actual benefits. Nevertheless, this is an indication of a lack of more urgently needed support functions. Technology centres could probably be more effective if they would offer additional services like innovation consultancy, knowledge transfer, and mediation of risk capital.

The technological level of firms benefiting from direct support, in particular the FFF scheme, tends to be high which leads to a situation where low-tech firms find it difficult, in some cases even impossible, to receive support for their innovation projects. The ranges of products and services of the SMEs responding to the SMEPOL survey in Upper Austria show that the FFF reaches disproportionally higher-technology firms. Twenty-seven of the SMEs which have received support from this instrument belong to electrical equipment and electronics, machinery, and services (frequently software) while only 19 belong to the metal-and-steel industry, metal products, plastic products, and wood and furniture. These results are confirmed by the general support statistics of the FFF where most firms belong to the more technology-oriented industries machinery, information and communication technologies, chemicals, data processing, and electrical equipment. Of course, there is no simple correspondence between industry and technological level (especially in the service sector), but the industrial structure is certainly not adequately represented in the sample of support clients. The FFF scheme tends to focus on those firms which are already innovative ("picking the winner"-strategy). Low-tech and little or not innovative firms are neglected. Often the latter firms do not even have the capabilities to apply for support (e.g., innovation project management skills). Support services targeting these deficiencies are still missing.

The support instruments in Upper Austria — direct support as well as technology centres — lack effects regarding strategic weaknesses, technology, innovation networking, marketing and market information, and commercialization (risk capital). In the case of the technology centres this is mainly a consequence of their profit-orientation and the lack of additional external (public) funds to perform such tasks. This impedes the provision of important but not or insufficiently profitable innovation services. Most Upper Austrian technology centres (except for the research activities of SWP and FAZAT) concentrate on services which can easily be put on the market. Therefore, important support services are not offered or are in short supply, because they do not yield immediate or sufficient returns. In the case of direct support there is the problem that certain barriers constraining innovation cannot be directly targeted by financial means. This leads to a situation where support is "over-effective" as far as financial problems are concerned, including funding of personnel. In this respect support is inefficient because problems have been indicated less frequently than respective positive effects (Table 7). On the other hand, support is hardly effective regarding problems due to strategic weaknesses, dependency, or insufficient external relations in the innovation process. It has to be considered, however, that these deficiencies are often underassessed by the firms themselves. It would be easy to conclude that there is simply no need. However, especially as far as innovation cooperations and market research are concerned, many SMEs are not fully aware of their deficiencies. They tend to neglect the fact that these aspects have an important role for their innovative capabilities and respective weaknesses can seriously hamper the innovation process. Therefore, before being able to offer respective support, it is necessary to raise at first awareness of these weaknesses and their consequences.

As far as strategy and dependency are concerned, both effects as well as problems were rarely mentioned. Here we find also the very few cases where barriers were more frequent, e.g., in the service sector. This might result in a situation of mutual "lock-in" where, on the one hand, firms lack awareness for deficiencies and, on the other hand, instruments do not target them. In some types of SMEs there is an especially outstanding mismatch between frequent effects and negligible problems. This applies to finance in the metal industry, personnel in machinery, and technology in the case of SMEs with more than average relative innovation budgets. This shows that it would be reasonable for the providers of innovation support to transfer some of their attention and resources from these "oversupported" areas to other weaknesses where support is more important.

6. Conclusions

The findings of our investigation of the innovation process of Upper Austrian SMEs and the effects of two types of innovation support instruments — direct financial support of innovation projects and technology centres — lead to the following conclusions.

Direct support seems to be quite effective as far as

Table 7
Correspondence of support effects and problems indicated by the SMEs[a]

Support effects on innovation process	% of supported SMEs		Problems constraining innovation
Financial effects: funds for investments, personnel, consultancy, reduction of risk	76.9	38.5	Financial problems: lack of finance, too high risk
Technological effects: technical services, technical know-how	26.9	10.3	Technological problems: lack of technical know-how, inavailable or too expensive technology
Manpower effects: funds for personnel	44.9	11.5	Manpower problems: lack of qualified personnel, lack of time
Strategic effects: market information, support for commercialization	9.0	9.0	Strategic problems: marketing and commercialization, no need for innovation
Reduction of dependency: initiation of cooperation with firms or science	10.3	9.0	Dependency: dominating customers, secrecy requirements of clients

[a] Source: SMEPOL-survey Upper Austria.

the financial bottlenecks of innovation projects are concerned. The limited financial capacity of SMEs is a widespread problem constraining their innovation activities. Nevertheless, it seems that support is not granted for the most urgent purpose. Usually, firms need most of all risk capital in order to be able to commercialize their innovations, and this is not covered by grants and loans, the usual form of financial innovation support at present. The availability of venture capital has been increasing in Austria in the recent past, but the major innovation support schemes have not yet adopted the provision of risk capital as a major instrument.

The fact that SMEs innovate in a way where human resources are used more intensively than large firms indicates that many firms need more adequately qualified manpower. Surprisingly, bottlenecks regarding human resources — lack of qualified personnel, technical know-how, and time — were rarely indicated by the firms. If one relies only on the stated needs it seems that direct support would actually be "overeffective" regarding the co-funding of personnel. We have to recognize, however, that in many SMEs the strategic, organizational, and technological deficiencies are latent. The firms are unaware of them or do not consider them to be important. Considering the modest effects of technology centres regarding technical know-how and technical services the cause is not only insufficient or inadequate supply but also the lack of demand. In order to be effective in these cases support instruments have to raise awareness first through proactive consulting, workshops and similar activities, rarely performed today.

Few SMEs are engaged in research activities. In order to enter into technology-intensive innovation activities, requiring scientific knowledge, firms will have to reconsider their business strategies. It is a fundamental change of the business activities of a firm when research is required for its innovation process, which has not been necessary before. To start research is part of a proactive innovation strategy aiming at new markets. The existing innovation support instruments, however, focus more on high-technology firms which are already involved in research (in particular the direct support scheme FFF), neglecting those firms which try to upgrade their innovation process on a level requiring research. There are also only few technology centres providing relevant support for this type of firm. The incubation centres are not engaged in such support activities at all while the research-oriented centres are primarily effective as far as the firms located in the centre are concerned but lack relations to external SMEs in the region.

Except for partners from the business sector — and here predominantly the customers — SMEs have few external relations in the innovation process. The lack of interaction with knowledge providers from outside the business sector seriously restricts the external influences enabling or stimulating innovation. The support instruments have not been successful in helping firms to establish relations with universities and other research organizations, especially interactive relations in joint innovation projects. In addition, technology centres are not the windows to sources of new knowledge and innovation outside the region they should be. The incubation centres do not perform this function at all, the research-oriented centres have too few relations with external firms. Furthermore, there are no knowledge providers below the scientific level, but this might change in the future with the increasing importance of technical colleges which are still very young institutions in Austria. In general, there is little support to improve the capacity of SMEs to establish links to innovation networks through market research and technology monitoring at present, especially as far as the collaboration with science and extra-regional institutions is concerned.

Overall, the innovation support instruments investigated in this research project do not sufficiently reach a significant part of the SME-sector — the low-technology and less innovative firms. In addition, specific needs of SMEs necessary to improve their innovation process — access to scientific knowledge and risk capital as well as innovation-related resources and information from

outside the region — are not met, neither by providing it directly nor by mediating. Direct support schemes should shift their activities more to risk capital, long-term funding of innovation, and the phase of commercialization. Technology centres should significantly increase their activities in the areas of brokerage and awareness raising and, if possible, engage in R&D below the scientific level but targeted on the activities and needs of the regional SMEs.

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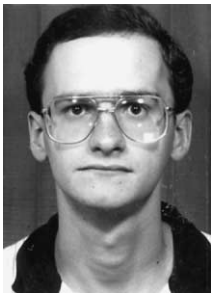

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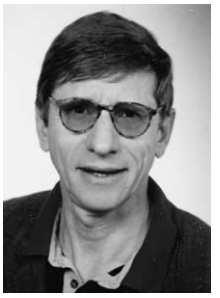

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