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SME Innovation and Support in Upper Austria

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Austrian Final Report

SME Innovation and Support in Upper Austria

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INTRODUCTION

This report is the Austrian contribution to the European TSER research project "SMEPOL" ("SME policy and the regional dimension of innovation"). The objective of this project is to analyze innovation policies aiming at SMEs, to evaluate their effectiveness and to propose potential improvements. For this purpose, important innovation support instruments for SMEs in several European regions - Upper Austria, the Triangle region in southern Jutland (Denmark), Lombardy and Apulia in Italy, Limburg in the Netherlands, Wallonia, northern and south-eastern Norway, Valencia in Spain, parts of London and its outer metropolitan area - have been investigated.

The following research questions have been analyzed: Which instruments are employed and how effective are they? To which extent do they reflect the new theoretical framework of the interactive innovation model? Or is the linear innovation model still dominant? Do they reach those SMEs which need support and do they offer the adequate support services? Is support addressing the most important problems SMEs are facing in the innovation process?

The goal of the research is to formulate some kind of "best practice" proposals for effective SME-innovation support based on the experience of all partners in the project. At the same time instruments should be sufficiently diversified to cover the needs of different types of regions and types of SMEs. The intention is to promote the knowledge transfer about innovation policy instruments and underlying models among relevant political actors and agencies in the regions studied.

This report is the Austrian contribution to the SMEPOL-project. It focusses on the region of Upper Austria. The report has four major parts: First, an introductory text describing the conceptual model of the research, its design and methodology, and presenting the investigated Austrian region. Second, a description of the national and regional innovation support system in general and an analysis of those support instruments which are most important for innovation activities of SMEs in particular. Third, an investigation of the innovativeness of SMEs in Upper Austria, the innovation barriers, and the effects of the selected support instruments on the firms' innovation activities. Fourth, conclusions regarding the strengths and weaknesses of the innovation support instruments and proposals for improvements.

1 The conceptual basis of the analysis

The investigation focusses on the following questions:

- What are the effects of innovation support policies for SMEs in certain regions?
- How efficient are they?
- Which are the main deficits?

Based on the answers to these questions it is intended to formulate proposals to improve the innovation support policies for SMEs according to "rules" for sound innovation support policies, deducted from theoretical lessons and specific evidence from the SMEPOL-project. Recommendations of operational strategies (methods) to put the rules into practice, based on these abstract principles for improvement, will have to be differentiated according to the specific requirements and conditions of

- regions
- firm sizes
- industries
- levels of technology

The analysis is based on the interactive, non-linear model of innovation since the traditional Schumpeterian and the linear product cycle model have been found more and more inadequate. Innovation is neither an exclusive internal activity of firms in order to achieve monopolistic advantages (Schumpeter, 1934). Nor is it proceeding in a mechanistic sequence from research to production and to the market, whereby research is considered as the main driving force, as the linear model and product cycle theory argue.

Increasingly, innovation is regarded as an evolutionary, non-linear and interactive process between the firm and its environment (Kline and Rosenberg, 1986; Dosi, 1988).

- The concept of non-linearity implies that innovation is stimulated and influenced by many actors and sources of information, both inside and outside the firm. It is not only determined by scientists and engineers working in R&D or the top-management. In addition, there are interactions feeding back the experience of production, marketing, and of customers into earlier phases of the innovation process.

- The interactivity of the innovation process refers to the internal collaboration between several departments of a company (R&D, production, marketing, distribution, etc.) as well as to external cooperations with other firms (especially with customers and suppliers), knowledge providers (like universities and technology centres), finance, training, and public administration. These are all contributing to a firm's capacity to innovate.

It is in this context that the concept of 'innovation systems' has been introduced. According to Lundvall (1992), an innovation system is constituted by actors and elements which interact in the production, diffusion, and the use of economically useful knowledge. It is a social system in the sense that innovations are the result of social interaction between economic actors, and it is an open system interacting also with its environment.

At the national level, industrial economists have demonstrated that industrial systems and institutions of countries are strongly interlinked. Innovations occur along specific trajectories, shaped not only by companies but by particular research environments, systems of education, finance, and regulation (Lundvall, 1992; Nelson, 1993; Edquist, 1997).

At the regional level, studies on innovative regions and milieux have shown that under certain conditions the innovation process becomes "embedded" in the region (Aydalot and Keeble, 1988; Camagni, 1991; Grabher, 1993; Tödtling, 1994a; Storper, 1995), leading to the formation of regional innovation systems (Cooke, 1997). The following factors and mechanisms have been identified:

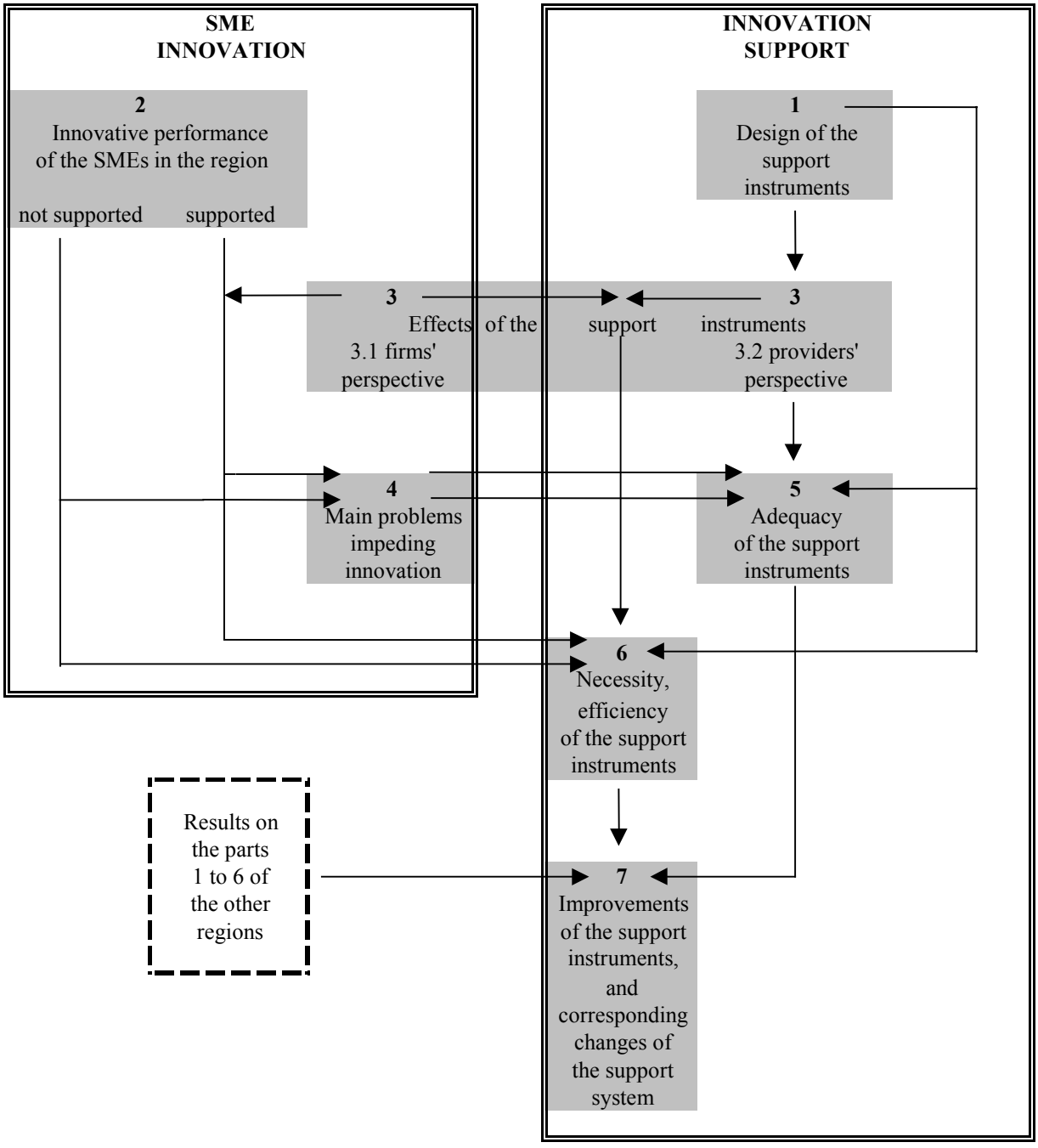
- First of all, regions differ in their preconditions for innovation such as qualification of the labour force, education, research institutions, knowledge externalities and -spillovers. Many of these factors are immobile, giving some regions advantages over others (Tödtling, 1992; Simmons, 1997).
- Industrial clusters often are localized, giving rise to networks and specific innovation patterns in regions (Grabher, 1993; Saxenian, 1994; Enright, 1995).
- A common technical culture may develop in local production systems through collective learning leading to innovative milieux (Camagni, 1991; Maillat, 1991; Asheim, 1996).
- University-industry links and knowledge-spillovers often lead to regional high-tech development (Castells and Hall, 1994; Tödtling, 1994b).
- Finally, regulation and support by regional agencies and policy is relevant both for small and large firms in the innovation process (Malecki and Tödtling, 1995; Sternberg, 1995; Hassink, 1996).

Elements of a regional innovation system, then, are first of all firms of the main industrial clusters of the region, including their support industries. They constitute various kinds of networks, both within the region and to the outside world (supplier/client-, cooperation-, information-networks) through which relevant information flows and interactions occur. Research institutions (R&D organizations, laboratories, universities) act as knowledge suppliers. They only become effective in the region, however, if their supply fits the demand of the firms. Furthermore, innovations and their success depend to a high degree on the quality of the labour force. Here, not just R&D personnel is relevant but also qualifications in production, marketing, and management. As a consequence, training organizations are another important element of a regional innovation system. Then, financial institutions have to be mentioned, providing finance for innovation projects to firms in the region. Last but not least, industrial associations and institutions like business innovation centres, science parks, or technology transfer centres support particular segments of firms (e.g., SMEs or young firms), helping them to overcome obstacles in the innovation process.

2 Research design

The following graphic presents the structure of the investigation of the innovation support for SMEs in Upper Austria. It comprises the parts of the analysis and the informational links between the steps of the research project. The aim is to show how the detailed investigations are linked together in order to achieve the objectives of the SMEPOL-project:

Figure I.1: The structure of the research project



3 **Methodology**

- Selection and investigation of the innovation support instruments:

We have selected the most important programmes and institutions which are available for companies in Upper Austria in order to support their innovation activities. The selection comprises also programmes which are not exclusively designed for SMEs. This is necessary, because most of the support instruments aiming at innovation, R&D, and technology are not restricted to SMEs. Nevertheless, most of their beneficiaries are in fact SMEs.

Because of the importance of national institutions in technology, research, and innovation policy, we had to include such programmes too. In these cases we will compare the effects on the Upper Austrian economy with the national total.

The following policy tools were selected for the investigation:
- Technology centres in Upper Austria
- Austrian Industrial Research Promotion Fund (FFF)
- ERP Fund - Technology programme
- ERP Fund - SME-Technology programme
- Innovation and Technology Fund (ITF)
- Regional Innovation Premium (RIP)

The analysis of the instruments comprised the collection of printed information materials, documents, and data, information accessible via Internet, and personal interviews. Information and data were provided by the institutions responsible for the funding programmes and the administration of the technology centres, by the Government of the Province of Upper Austria, the Upper Austrian Technology and Marketing Corporation (TMG), and the Austrian Statistical Office. We conducted interviews with representatives of the funding programmes, the regional technology centres, and TMG.

- Survey on innovation in and innovation support for Upper Austrian companies:

The survey consists of two samples:
a) The test sample which consists of the
- participants of the selected programmes (FFF, ERP-TP, ERP-SME-TP, ITF, RIP) and
- firms located in Upper Austrian technology centres or using their services

b) The control sample which comprises the most important industries of the Upper Austrian manufacturing sectors and, additionally, producer services.

Addresses of firms were provided by the FFF (all recent beneficiaries of FFF-support) and the ERP (only those beneficiaries which accepted to participate in the survey). Further, a complete list of firms located in technology centres was available. Additionally, we got a list of addresses of the Wirtschaftkammer Oberösterreich for the following manufacturing industries: glass, chemicals, wood products, machinery, metal products, electrical equipment and electronics, textiles, and

clothes. The service sector is represented by engineering (technical bureaus). As far as the selected industries are concerned, the list is complete, because firms are obliged to be members of the Austrian chamber of commerce. Due to the fact that the member firms of the chamber of commerce frequently belong to more than one industrial category, the sample consists also of other industries.

- Collection and analysis of additional literature:

Wherever possible, we have used additional information of studies and literature (see references). With these materials our investigation could be made more comprehensive and the validity of certain results could be checked.

- Definition of the term 'SME' and size categories:

The term 'SME' is operationalized applying two of the criteria used by the EU (1996). These criteria are 'employment' and 'ownership'. We use the following limits and restrictions for a firm to be classified as 'SME':

- less than 250 employees and
- not more than 25% owned, either singly or jointly, by a larger company

Within the employment limit we differentiate between the following three size classes:

Table I.1: Employment size classes of SMEs

	Number of employees		
Very small:	1	-	9
Small:	10	-	49
Medium:	50	-	249

4 The investigated region - the province of Upper Austria

The general classification of the regions consists of 4 categories. Some of these categories can apply to the same region. In this case the relatively most important category is used for the general classification.

Table I.2: Upper Austria's position within regional categories

Type of region	*Economic characteristics*	
Peripheral:	Little manufacturing, primary sector relatively important, few local firms as potential innovation partners, few innovation-related service firms and R&D-institutions.	*
Old industrial:	Large firms in traditional (often stagnant) manufacturing industries, nationally and globally oriented and linked, maybe in the process of restructuring, SMEs often subcontractors to the large firms, only rarely producing for final market.	**
Small firm:	Mostly in traditional manufacturing industries, several firms in the same production system, often forming networks and cooperating in innovation.	
Central:	Diversified industrial base, knowledge-intensive and high-technology industries, often important element of the national system of innovation with links on this level.	*

** = Applies primarily to Upper Austria, * = Applies to some areas of Upper Austria

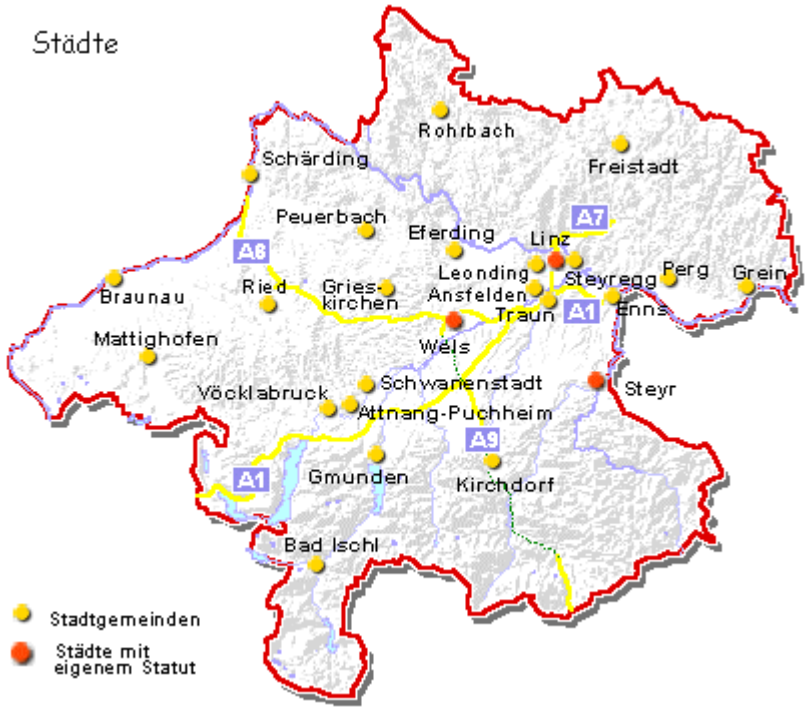
According to this classification Upper Austria belongs primarily to the 'old industrial' type. Nevertheless it also consists of significantly large peripheral areas and a more high-technology-intensive centre. Small firms are - like in the rest of Austria - predominant in the economic structure. But Upper Austria cannot be considered as a typical small-firm-region as far as this term is applied in the sense of the definition of table I.2.

In the following chapters, we will present some key data on the province of Upper Austria and its economy.

4.1 General information about the Austrian province of Upper Austria

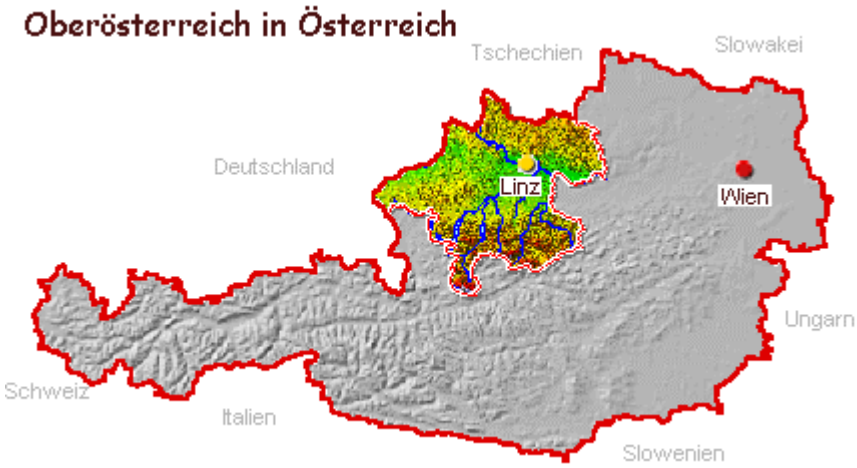
Upper Austria is sufficiently large to form a separate spatial entity - both in administrative and economic perspective. Its area is 11,980 km^2 (14.3% of Austria) with 1.378,091 inhabitants (17.1% of Austria). It is a province ("Bundesland") of the state of Austria with a wide range of competences for economic policy (nevertheless constrained by a clearly lower financial capacity than the nation state). It is therefore a reasonable research object for this project. It has a differentiated economy, a few central cities (Linz - the regional capital with 190,000 inhabitants, Wels, and Steyr), a differentiated institutional setup (administration, university, training) and quite dynamic political actors.

Figure I.2: The province of Upper Austria and its location in Austria



1) Light grey marked cities are normal municipalities, dark grey marked have higher ranking administrative status.

2) A1 to A9 indicate motorways.



Source: OÖ LReg

Upper Austria borders on three Austrian provinces - Lower Austria, Styria and Salzburg - and two foreign countries - Germany and the Czech Republic. Linz is approximately halfway between Vienna and Munich. It has a high-rank transport system (motorways, railroads, the river Danube, and a small airport) linking the eastern part of Austria and countries like Hungary with Germany (and the European Union).

The province can be characterized by

- a long industrial tradition in manufacturing, primarily based on metal and steel
- an disproportionate large share of machinery, transport, and mining compared to the Austrian industrial structure
- a significant structural adjustment process in the eighties following a severe crisis of the large state-owned companies
- a very similar size distribution of plants compared to Austria

Despite structural problems, the region's economic performance has been above the Austrian average in the post-war period (see also chapters 4.2 and 4.4 of part I).

Upper Austria consists of an industrial core region formed by the three cities Linz (the capital of the province), Wels, and Steyr. This subregion has a long manufacturing tradition based on metal/steel-products and machinery. Today, the product range is very broad, covering diverse products like raw materials and combustion engines. Another relatively important industry in this region is chemicals. Outside this core area there are two rather large peripheral regions in the north and south of Upper Austria. The southern part belongs to the Alps and has a long tradition in mining. In addition to these two very different types of subregions there are several (smaller-scale) industrial centres.

The next table summarizes several key indicators of Upper Austria in relative terms in order to show the relative weight of the province 'Upper Austria' in the state of Austria. This will make it easier to assess the meaning whenever a share of Upper Austria will be presented in the following analysis.

Table I.3: The share of Upper Austria with regard to key data in %

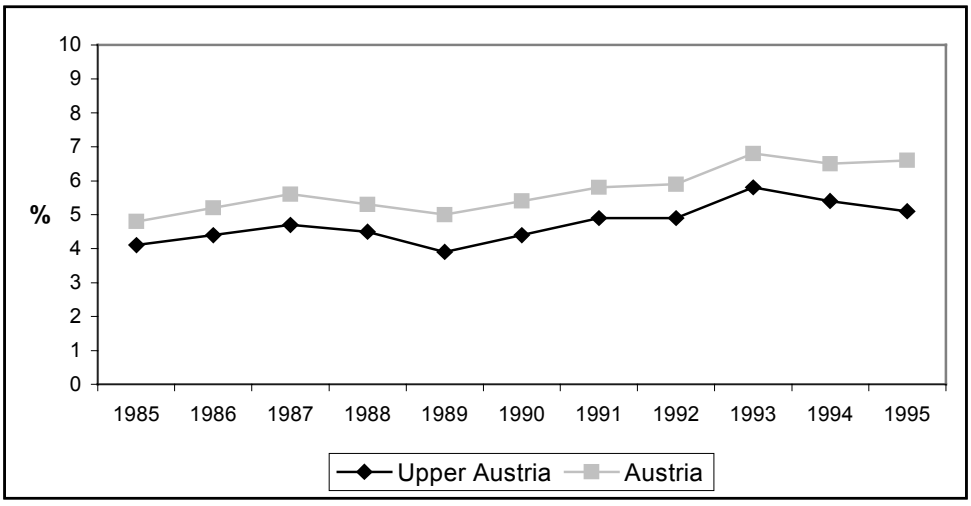
	%
Area	14.3
Population	17.1
Total employment (1995)	16.8
Contribution to GDP (1992)	16.3
Manufacturing sector (1993):	
Plants	19.5
Employment	23.4
Gross product	22.4
Service sector (1993):	
Firms	12.3
Employment	14.2
Gross product	13.1
R&D-expenditure of companies (1993)	17.3

Source: WK-Österreich, ÖSTAT

4.2 The industrial activity in Upper Austria

In all years since 1985 the rate of unemployment in Upper Austria has been lower than in Austria. In general, there has been a rising trend in the case of both time series until 1993. The total number of employees has increased significantly between the late eighties and the early nineties and has remained more or less constant since 1992. In 1985 employment was 462,000, in 1995 it has increased to 515,000. Again, the development has been very similar in Austria. The share of Upper Austrian employment in the national total (around 16.7%) has hardly changed in this period of time (Hauptverband d. österr. Sozialversicherungsträger).

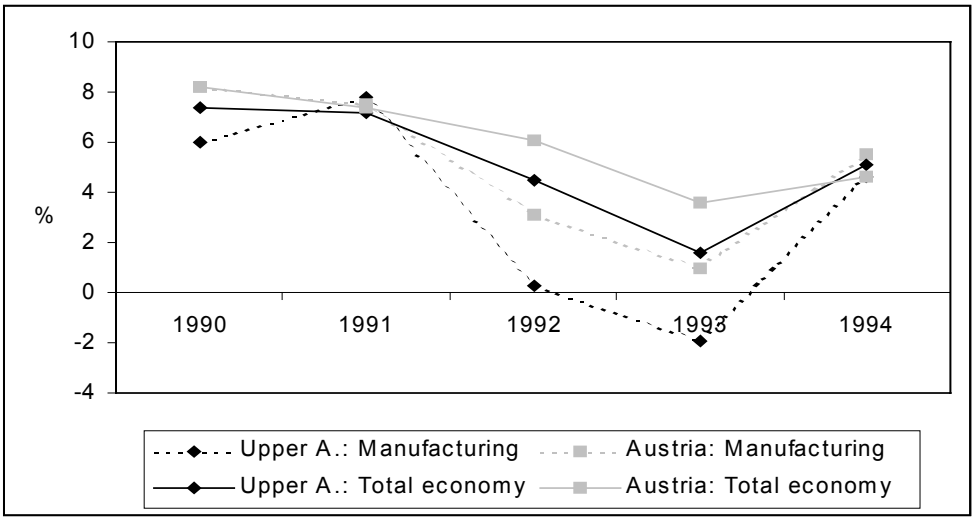
Figure I.3: Rates of unemployment in Upper Austria and Austria



Source: ÖSTAT

Looking at the GDP-data, the regional performance is quite similar. From the mid-70s to the mid-80s, the share of Upper Austria has increased up to 17% in 1985, then slightly decreased. Since 1990 it has remained relatively constant arriving at 16.3% in 1992 (ÖSTAT).

Figure I.4: Rate of change of value added (in nominal terms) against the previous year (in %)



Manufacturing includes also mining, energy, and construction.

Source: WK-OÖ, ÖSTAT

4.3 The structure of the regional economy

The following table shows that small and medium-sized plants outnumber the large ones by far. Large firms are slightly more frequent in the manufacturing sector than in other sectors of the economy, but still 96% of all plants employ less than 100 people. This is very similar to the Austrian size structure. Most people in Upper Austria work in plants with 20 to 99 employees. As far as the manufacturing sector is concerned, the most important size class is larger (100 - 499 employees).

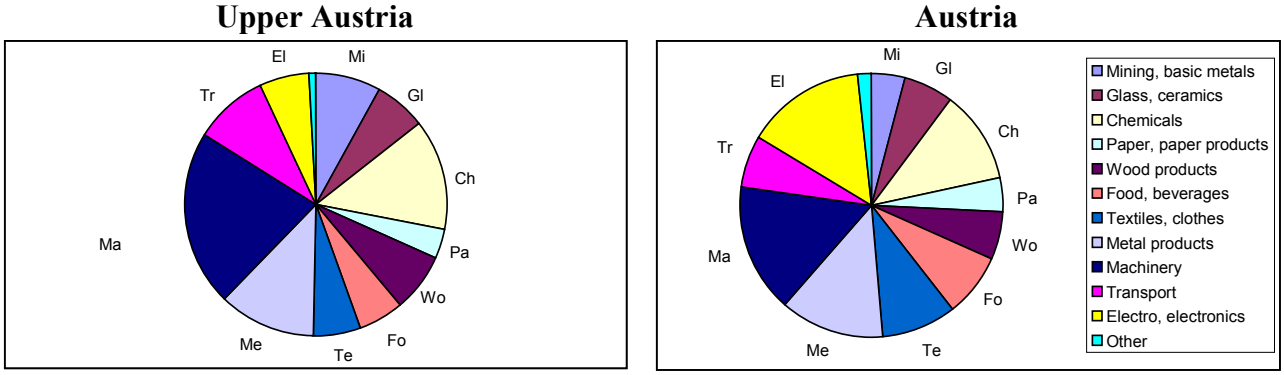
Table I.4: Distribution of size classes of plants in Upper Austria

	P l a n t s :		*E m p l o y m e n t :*	
Number of employees	*Total economy*	*Manufacturing*	*Total economy*	*Manufacturing*
Total number	25 552	9 732	346 961	217 228
Share of (in %)				
1 - 4	55.6	46.2	8.4	4.5
5 - 19	31.8	34.4	21.7	14.6
20 - 99	10.6	15.2	30.3	28.6
100 - 499	1.9	3.8	27.8	34.6
≥ 500	0.1	0.3	11.7	17.7

Source: WK-OÖ

With regard to the industrial structure there are more significant differences between Austria and the province 'Upper Austria' than in the size-distribution:

Figure I.5: Industrial structure (manufacturing) in Upper Austria and Austria in 1995 (number of employees)

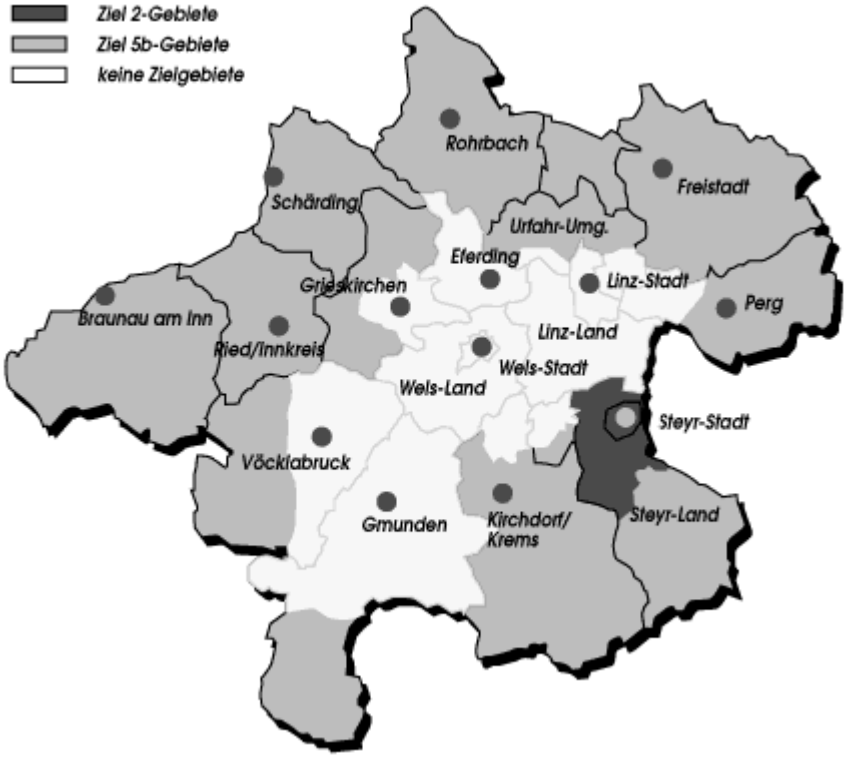


Source: WK-Österreich, ÖSTAT

The most remarkable differences are the greater weight of machinery and the lower weight of electro/electronics in Upper Austria (in terms of employment). Other industries which are more important in Upper Austria than in the nation are transport and mining. Less important are textiles/clothes and food products.

The economic activity is, of course, not equal throughout the province. The differences can be easily seen regarding the objective areas for EU-Structural Funds in Upper Austria. At present, there are two types of such areas present in the region: Objective 2-regions (conversion of regions seriously affected by industrial decline) and Objective 5b-regions (development and structural adjustment of rural areas).

Figure I.6: Objective areas in Upper Austria



Source: TMG

Overall, a significant part of Upper Austria is allowed to receive support through Structural Funds. Objective 2-areas (dark grey) comprise the city of Steyr and its surroundings (Steyr-Umgebung). Objective 5b-areas (light grey) comprise more peripheral districts of Upper Austria: Kirchdorf, Steyr-Land, a part of Vöcklabruck, Braunau, Ried, Schärding, a part of Grieskirchen, Rohrbach, Urfahr-Umgebung, Freistadt, Perg. Only three districts (Linz, Wels, Gmunden) have no objective areas at all (without shading). However, the relatively large number of districts applicable for Structural Funds is likely to decrease in the future.

4.4 A short economic history of Upper Austria

Pre-war Upper Austria was still dominated by agriculture with nearly half of all working people. The manufacturing sector was rather small and concentrated on a few locations, especially Linz (18% in terms of employment) and Steyr (16%). Compared to other Austrian regions, Upper Austria ranked fourth in industrial employment, far behind Vienna, Lower Austria, and Styria. Most firms were small with one significant exception - Steyr-Daimler-Puch (SDP), a large vehicle

company. Besides transport, the most important industries were minerals/ceramics, textiles, food, and paper. The economy was heavily affected by the great depression (1929) leading to a reduction of industrial employment by 41%. With the German occupation of Austria in 1938, the Upper Austrian economy entered into a period of major changes. The importance of Upper Austria for Germany during the Second World War was primarily due to its nodal position in important north-south and east-west trading routes and the large potential for hydroelectric power generation. Except for SDP, few companies and natural resources were interesting for German wartime economy. The Germans regulated the economy according to military needs. The manufacturing of consumer products (especially textiles) was reduced in favour of production required for warfare - machinery, metal and steel (especially aluminium), engines and guns from SDP, chemicals. According to German interests, new firms were established in Linz, Ranshofen, and Lenzing. This resulted in an increase in industrial employment from 44,500 in 1939 to 77,200 in 1944. The Germans focussed strongly on very large firms concentrated in few locations: Linz, Steyr, and Wels. In spite of the deteriorating military situation of Germany, there were hardly bottlenecks in Upper Austria regarding resources and labour (due to foreign forced workers). Air-raid damages became serious only in the last year of the war. From 1943 on German firms started to relocate their production to relatively safe regions in Austria like Upper Austria. But the effects of these activities on the Upper Austrian industrial production capacity remained negligible, because Nazi-Germany collapsed soon. At the end of the war, the industrial capacity of Upper Austria was seriously damaged by air-raids, looting, dismantling, and insufficient maintenance. By 1945 a major transformation of the industrial structure of Upper Austria had taken place. The share of metal-and-steel, machinery, and chemicals sectors had increased significantly. Transport had remained important, but other industries like textiles had decreased. The locational structure had changed, too. Linz had become the most important industrial location in Upper Austria; new locations (Braunau, Lenzing) had appeared. Due to the vanishing textiles industry, the northern part of Upper Austria ("Mühlviertel") had declined and is still lagging behind today. In spite of the extension of military production, the position of Upper Austria's industry did not change compared to other Austrian provinces, because they were undergoing the same process (Lackinger, 1997).

The post-war development to one of the leading industrial regions of Austria was favoured by specific circumstances at the end of the war. First, Upper Austria was controlled by the US army. The USA did not follow a policy of radical confiscation of manufacturing equipment like the Soviet Union in the eastern parts of Austria. A large part of the most important companies in Upper Austria were nationalized in order to restructure their production towards civil requirements and to avoid confiscation. Second, Upper Austrian manufacturing firms benefited more than proportional from the European Recovery Programme (ERP). Overall, Upper Austria could therefore improve its relative position against the former leading industrial regions in Austria. In the first decade after the Second World War there was a boom in start-ups, including the upgrading from small craft firms to larger manufacturing companies. The industrial structure of Upper Austria became more diversified (e.g., the manufacturing of electrical equipment). Consumer good production decreased relative to producer goods. The spatial pattern of locations became more decentralized (Lackinger, 1997).

At the end of the war, the German metal-and-steel and chemicals plants were still fragmentary. After the war, they were extended to vertically integrated manufacturing entities. A major technological innovation - the LD-process for smelting - supported the emergence of the large

metal/steel-company VÖEST in Linz. These state-owned companies were extremely large for Austrian dimensions and, therefore, had to compete on the global markets. The nationalized sector had an important function in the Austrian deficit-spending policy to fight recession after 1973. Mainly due to political reasons the VÖEST grew to more than 80,000 employees. The company had to take over other Austrian steel-companies which were already facing serious problems. The political objective "full employment" was considered more important than the competitiveness of the firms. 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. The state could not any longer compensate for the huge losses. Finally, the conglomerate had to be split up and privatized. Many parts were selled to foreign companies. As a consequence, employment was reduced significantly leading to serious problems in the early 1990s (Lackinger, 1997).

On the contrary, the private manufacturing sector and SMEs performed quite successfully. After a short period of reorganization, most companies which were newly formed out of the nationalized conglomerates were able to yield profits again. Nevertheless, they had been downsized strongly. Employment in the metal-and-steel sector had decreased therefore which could not be offset by other manufacturing industries. Instead, services grew strongly. Overall, the recovery after the crisis was successful. At present, Upper Austria is one of the provinces of Austria with the best economic performance. Between 1994 and 1995 the gross production value increased by 3.8% in real terms. In Austria, for comparison, the increase was only 1.8% (Lackinger, 1997).

II

INNOVATION SUPPORT FOR COMPANIES IN UPPER AUSTRIA

Part II of the report deals with the support system for innovation activities of Upper Austrian firms. According to the aims of this project, we will especially focus on those programmes and institutions which are primarily designed to support SMEs. We have selected the most important programmes and institutions which are available for companies in Upper Austria in order to support their innovation activities. The selection comprises also programmes which are not exclusively designed for SMEs. This is necessary, because most of the support instruments aiming at innovation, R&D and technology are not restricted to SMEs. Nevertheless, most of their beneficiaries are in fact SMEs.

Because of the importance of national institutions in technology, research, and innovation policy, we had to include such programmes too. In these cases we will compare the effects on the Upper Austrian economy with the national total. The following policy tools have been selected:

- Technology centres in Upper Austria
- Austrian Industrial Research Promotion Fund (FFF)
- ERP Fund - Technology programme
- ERP Fund - SME-Technology programme
- Innovation and Technology Fund (ITF)
- Regional Innovation Premium (RIP)

Table II.1: Criteria for the selection of the innovation support instruments

Criteria	*fully applying (partly applying) to the following instruments:*
Aiming at innovation/R&D:	FFF, ITF, RIP (ERP-Technology programme, ERP-SME-Technology programme, Technology centres)
Explicit SME-focus:	ERP-SME-Technology programme (ITF as far as a small sub-programme is concerned)
Regional focus:	RIP, Technology centres
Regional organization:	Technology centres
National organization:	FFF, ERP-Technology programme, ERP-SME-Technology programme, ITF
Joint national/regional organization:	RIP

The basic methods used by these support instruments are clearly dominated by the "traditional" means of direct support - grants and low-interest loans. In addition, national institutions have a very strong position in the innovation support system.

Table II.2: Types of innovation support

Support methods	*provided by the following instruments:*
Direct support	
via grants:	FFF, ITF, RIP
via loans:	FFF, ERP-Technology programme, ERP-SME-Technology programme
Provision of venture capital:	Existing, but of negligible importance
Technology transfer/consultancy:	Technology centres
Brokers, stimulating contacts to service providers and knowledge suppliers:	No special programme, to a limited degree done by technology centres
Mobility schemes (temporary graduates in companies):	Very small sub-programme of FFF
Quality improvement, upgrading:	Partly done by technology centres

For the selected instruments we are going to deal with the following questions:

a) What are the aims and targets of the programme?
- Which aspects of innovation or R&D are targeted (research, development, commercialization)?
- Are there primary target groups of companies (size classes, sectors, technologies)?
- What is the support method (funding, provision of equipment, consulting, mediation)?

b) What is the position in the total regional or national system of innovation- and R&D-support?
- What is their degree of autonomy?
- Where do the financial resources come from?
- What are the relations with other elements of the support system on the same spatial level?
- What are the relations with support institutions on other spatial levels?
- What are the relations with companies in general and SMEs in particular?

c) How did the programme evolve? Were there major changes in the original intentions?

d) What are the technical and organizational details of the programme?

e) What are the results and effects of the support activities?
- What is the amount of the resources available for support?
- How many firms have been and are participating?
- To what extent are projects supported?

f) Did the support institution perceive any deficits regarding their instruments?

g) Which are the future plans regarding the programme? Are there plans for major strategic changes (especially according to the networking/innovation system approach) or only for minor improvements?

1 The innovation support system in Austria

Before we concentrate on Upper Austria, it is reasonable to analyze the general situation regarding innovation support in Austria. What is relative importance of the state of Austria, its provinces, and the companies in funding R&D? The data of the following table lead to two conclusions: First, the public sector is nearly as important as the private sector regarding R&D-expenditures. Until 1994 the public share was rising, since then it has decreased. Second, within the public sector, national funds are predominant. The share of the provinces remained rather constant during the 1990s.

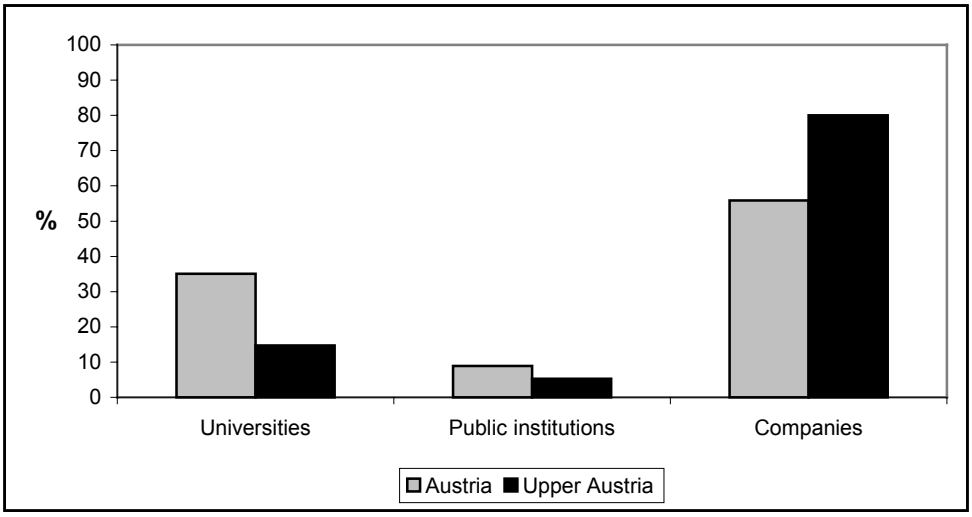
Table II.3: Total R&D-expenditures by state, provinces and companies

		R&D expenditures provided by the		
	Total	*State of Austria*	*Provinces*	*Companies*
1990	1861	37.6	5.8	52.0
1991	2104	39.7	5.9	50.2
1992	2204	40.5	6.1	49.3
1993	2303	41.6	5.6	49.0
1994	2519	42.7	6.3	47.3
1995	2611	41.8	6.4	48.0
1996	2649	40.8	6.2	49.4
1997	2697	39.6	6.2	50.5
	(million EURO)	(%)	(%)	(%)

Source: ÖSTAT

Within the public sector the main institutions financing R&D are the universities. But this applies primarily to the national level. As far as Upper Austria is concerned, the importance of the universities is far lower whereas companies are more important.

Figure II.1: Share of different institutions in total R&D-expenditures (in 1993)



Source: ÖSTAT, TMG

The Austrian innovation support system is dominated by a few funding organizations, mainly offering direct support like grants and loans within the framework of several programmes. The following figure summarizes the structure of the Austrian national research and innovation support system:

Figure II.2: The main institutions in the Austrian innovation, R&D and technology support system

Institution:	**FWF**	**FFF**	**ITF**	**ERP**
Functions:	* Funding * Project evaluation/ administration	* Funding * Project evaluation/ administration * Administration of additional external programmes	* Funding	* Funding * Project evaluation/ administration * Administration of additional external programmes
Orientation:	Bottom-up	Bottom-up	Top-down	Bottom-up
Primary instruments:	Grants	Loans, grants	Grants	Loans
Target sector:	Science, research	Business	Business	Business
Target stage in the innovation process:	Basic research	Applied R&D		Commercialization

This graphic shows that the big national technology and R&D support institutions still follow the linear innovation model. Each fund is responsible for a certain stage or phase in the innovation process.

2 The regional innovation support system in Upper Austria

We will first present an overview of the technology and innovation policy in the province of Upper Austria. We will see that technology centres are (still) the most important support instruments available at the regional level.

2.1 Technology and innovation policy in the province of Upper Austria

It is a difficult task to separate innovation-related subsidies from funds used for other purposes. There is a very broad range of usually minor-scale subsidies available for Upper Austrian companies. It is often not clear to what extent they actually refer to innovation. The following table comprises the most important provincial instruments with a rather unambiguous orientation towards innovation and technology:

Table II.4: Technology and innovation oriented support instruments of the province of Upper Austria (most recent data)

	First year of activity	*Total funds since the beginning (million EURO)*	*Projects, participants*	*Funds per project, part.* (1000 EURO)*
Contribution of the province to RIP	1991	10.5	104	101
Support for technology centres	1992	3.6	6	606
Provision of venture capital	1997	2.8	12	233
Investment subsidies for universities	1992	2.5	60	42
Telecommunication and computer networks	1995	1.3	570	2
Research transfer	1993	0.4	94	4
Teleworking	?	0.005	3	2

* Estimated amounts, real funds per project/participant can vary.

Source: OÖ LReg

The oldest instrument with the largest cumulated funds is the contribution to the Regional Innovation Premium (RIP). This is not an autonomous provincial instrument, but a cooperative programme between the state of Austria and most provinces. It is described separately in chapter II 3.4.

The highest amount per year, though, results from the venture capital programme of Upper Austria. This instrument exists only since 1997, nevertheless nearly 3 million EURO have been already used for this scheme. This programme is targeted on SMEs (according to the EU-criteria) which need

capital for innovations, structural changes, start-ups, take-overs, and market expansion. The minimum participation is about 73,000 EURO (1 million ATS), the maximum is about 363,000 EURO (5 million ATS). The period of participation is agreed individually, between 10 and 20 years. Return on the participation has to be payed partly dependent on the profits. The future of this programme is uncertain, however. It is unlikely that the critical mass for a viable regional venture capital system can be reached. According to the most recent technology policy strategy, this programme will not be continued (see the strategic programme "Oberösterreich 2000+" later in this chapter).

Three of the programmes, listed in table II.4, are concerned with support for infrastructure which is important for technological upgrading and R&D. The biggest share accounts for the support of technology centres in Upper Austria. On average, each technology centre has received subsidies of about 600,000 EURO. In addition, the province has supported institutes of the University of Linz, which also includes departments located in one of the centres - the "Software Park Hagenberg" (see chapter 2.2 of part II). These subsidies are targeted on investments in infrastructure and R&D-equipment. Finally, a relatively large number of companies has received grants to upgrade their telecommunication infrastructure and to install or improve computer networks. This programme is intended to raise the level of regional firms in a key technology for competitiveness - modern ICTs. Because of the many participants, the funds per firm are rather low (only about 2,300 EURO).

The research transfer programme, intended to improve the Upper Austrian university's ability to spread technological know-how resulting from its scientific activities, is still in an experimental phase. This explains the small volume of funds. Nevertheless, it has been working since 1993 already and comprises 94 projects in this period of time.

Only one programme, the support for teleworking, has not been accepted by the firms so far. Only three projects have been subsidized with negligible grants. This shows that this form of working relation is still far from being widely recognized in companies.

The total R&D-related expenditures of the province are of course higher than the selected instruments in table II.4 suggests, because it also comprises funding of R&D in the non-profit sector. The development of the total public R&D-budget of Upper Austria since 1990 is presented in table II.5.

The importance of public R&D-funding in Upper Austria is rather low. If we compare the total public R&D-funds of Upper Austria (16.7 million EURO in 1996) with the total support for companies in this province (162 million EURO in 1996), it can be seen that other purposes like revitalization or job creation exceed R&D and innovation as target areas by far.

Table II.5: Funds for R&D provided by the province of Upper Austria

	R&D-funds (million EURO)	*Share in Austrian public R&D-funds (%)*
1990	10.9	10.0
1991	13.5	10.9
1992	15.2	11.5
1993	14.2	9.8
1994	15.0	9.5
1995	15.4	10.0
1996	16.7	10.4
1997	17.1	10.4

Source: ÖSTAT, OÖ LReg

Policy in Upper Austria became interested in technology policy only recently. This can be explained partly by the relative better performance of the Upper Austrian economy compared to other provinces of Austria and partly by the dominance of the business sector in R&D. In Upper Austria the university institutions are of relatively little importance. The university of Linz is very small compared with major science locations in Austria - Vienna and (especially in the technical sciences) Graz, the capital of Styria. There are no contract research organizations in Upper Austria. This has led to a business-centred approach of policy, which is reinforced by a general tendency to avoid any state interventionism.

Nevertheless, the importance of technology policy has been finally recognized and has resulted in the establishment of an institution which has to focus on these issues (in addition to general investment policy). In 1992 the **Technology and Marketing Corporation** (TMG) was founded, organized as an independent institution, in order to support public activities in stimulating technological development and investment in the province of Upper Austria. In former times support for innovation projects was rather inconsistent and isolated. It is a central task now of the TMG to formulate systematic strategies regarding technology and innovation.

In conceptualizing a regional technology policy, the management board of TMG tries to follow a "technical" approach as independent from politics and lobbies as possible. In fact, this is made easier by the fact that there are good cooperative relations to several interest groups in the province such as the chamber of commerce and the chamber of labour. Following the tradition of the Austrian so-called "social partnership", the atmosphere between these actors is quite positive, especially with regard to strengthening the competitiveness of the regional economy. Of course, this cannot prevent political discussions about technology policy strategies. Recently, the TMG together with external experts has formulated a strategic programme ("Oberösterreich 2000+") which was heavily discussed and contested. Conflicting opinions appeared mainly regarding the topics "direct support for firms" and "support for industrial versus scientific research".

The objectives of the strategic programme for Upper Austria are (TMG, 1998):

- Strengthening of the transfer of technology and knowledge
- Support for promising future technologies
- Innovation through cooperation
- Improvement of human capital
- Support for start-ups
- Improvement of infrastructure
- Reform of the public administration
- Support for exports
- Strengthening of international cooperations
- Consideration of "soft" factors in economic policy
- Innovative tourism
- Public intervention in strategic fields like energy
- Strategy-oriented budget policy

Most of these objectives are catchwords to which everyone will agree. How to achieve these goals requires more detailed proposals. The report contains 19 measures, grouped along three major strategies: technology, qualification of workforce and location marketing. According to the focus of the SMEPOL-project, we will concentrate on the technology strategy.

First, the report lists several measures to improve *applied R&D*. Funds shall be concentrated on R&D-activities which are required for the transfer of technologies. The concentration on basic research is considered too expensive for Austria or one of its provinces. The report follows the national strategy to establish competence centres for specific technological fields. The character of their R&D-activities shall be applied. R&D should be done in close cooperation between companies and universities. The larger part of the funds for these centres shall come from contract research (i.e., from business), the smaller part from research subsidies offered primarily by Austrian and European Union R&D-programmes. The provincial contribution is obviously not intended to become of significant importance. The technological fields which should be aimed at represent the current strenghts of Upper Austria's economy and science: information and communication technologies, new materials, chemicals and environmental technologies, mechatronics, industrial mathematics, industrial design and new media, medical technologies, logistics. Competence centres shall, in addition to the "traditional" technology transfer, stimulate spin-offs and the mobility of researchers. Primary targets are SMEs lacking the required technical equipment and know-how for high-tech innovations. The authors are convinced that the close involvement of business representatives is necessary for the effectiveness of these centres.

Second, following the model of Styria, the formation of *clusters* shall be supported. It is assumed that clusters have a positive effect on innovativeness. The report lists six existing and two potential clusters in Upper Austria. To some extent cluster structures can be found in 'steel, aluminium, metal products', 'machinery, environmental technologies', 'vehicles, engines, components', 'plastic products', 'furniture, windows, doors', and 'paper, pulp'.

Chemicals and food are seen as "latent" clusters. The number of clusters seems to be rather optimistic. In fact, the authors admit that there are deficits which have to be removed to achieve

fully developed clusters. It is considered that often there are only weak relations between the firms in these clusters. Additionally, several elements are missing. These are especially producer services and research institutions in the region. It is further referred to the necessity to keep the clusters open for influences and relations with actors beyond the region. Difficulties to integrate SMEs into such networks are also recognized. But there are no answers to these questions yet. It is obvious that there is little consideration of critical aspects of clusters with regard to innovativeness like actual power relations and mutual lock-in effects.

Regarding the means to support the formation of clusters or the intensification of the network relations the programme relies primarily on information and consulting activities. Additionally, the province should provide funds for a few cooperative innovation projects which are likely to reinforce cluster structures. In the future, further stimulating effects could come from a competence centre for vehicles not existing at present.

Third, institutions and programmes providing *technology transfer* services shall be improved. The measures focus especially on SMEs and their problems to get into contact with universities, to apply for R&D-project funds and to find the relevant information. The main problem in Upper Austria is seen in the lack of a central agency for technology transfer. The following proposals are intended to improve the technology transfer system in Upper Austria:

- Support for those firms which apply for R&D-project funds for the first time.
- Creation of a programme which supports so-called "innovation assistants" in SMEs. Such persons are graduates of technical universities and colleges which support, stimulate and organize the innovation process of SMEs. The firm receives a part of his assistant's salary in the form of grants for a limited period of time (up to 2 years). This programme should be administrated by already established support institutions like the FFF (see chapter 3.1 of part II).
- The province should provide scholarships for foreign students in order to "import" international knowledge as well as to establish long-term links to these countries when the students eventually return.
- The existing technology and incubation centres shall be improved and extended. These centres shall offer a broader range of innovation-related services than today. The improvement of the existing centres is considered clearly more important than the setting-up of new centres. The opinion is that there are already enough centres throughout Upper Austria. Referring to the funding of these centres it is still planned to rely primarily on private investment and to restrict public funds to additional support and certain high-tech-projects.
- A central agency for technology transfer in Upper Austria shall be established at the University of Linz ("Upper Austrian Research Corporation") responsible for the mediation of scientific knowledge to companies in the province. It is intended to become the central technology transfer node not only for the University of Linz but also for the technical colleges and individual researchers in Upper Austria.

Interpreting the strategies it can be concluded that the network approach to innovation has been widely recognized by those institutions and persons which are responsible for technology and innovation policy. But, to what extent and in which way the interactive model of the innovation process is going to be realized remains to be seen.

Considering the required funds for all the proposed measures it becomes clear that the programme relies strongly on additional funds provided by the state of Austria, the EU and private companies. The contribution of the province will be 73 million EURO (1 billion ATS) for 5 years. The scarcity of provincial funds required a selection of certain instruments. A prominent casualty is the regional venture capital programme (see data in table II.4). The authors of the report considered it impossible to reach the critical mass for an effective venture capital programme. The growing number of national and international funds led to the conclusion that enough venture capital should be accessable for Upper Austrian firms, so the existing programme should not be extended.

The main problem of the TMG in designing the technology policy of Upper Austria is caused by its lack of responsibility for the actual funding. This is still done by the provincial government. The government has still the contract authority for all subsidies. This means that the TMG has no own funds for support activities. In fact, it can only recommend to support certain activities or projects. Therefore, the TMG is still a small organization. It has 12 employees, 6 are active in investment and technology marketing, the others are administration personnel.

According to the fact that federal funds are relatively less important in Upper Austria than in other regions due to the lack of university and research institutions, the province tries to raise their own funds to support R&D. It has been recognized that industrial R&D, even in the case of the relatively more active Upper Austrian companies, is not sufficient. Regional funds for R&D-projects are increasing, but there is still a large gap to be filled. There are serious doubts about the efficiency of traditional direct support for R&D and innovation. This is the main reason why Upper Austria is the only province besides Vienna which has no co-financing agreement with the FFF (see chapter 3.1 of part II). The view of TMG is that this kind of participation would not result in any additional R&D-activities. Firms would simply take along the subsidies without really needing them to realize their innovation projects. Upper Austrain firms already account for a high share of the FFF-funds without co-funding. It is the view that co-funding would not lead to additional innovation projects. Provincial funds should be saved for other purposes.

The most important focus of regional technology policy aims at technology centres. The provincial government supports the regional technology centres with amounts up to 727,000 EURO (10 million ATS) for one centre. Support for operating costs is clearly lower and is primarily provided by the chamber of commerce with about 36,000 EURO (half a million ATS) per centre. The funding of technology centres is a mixture of public and private sources, such as banks. Most centres are privately organized and therefore not directly controllable by public institutions.

Nevertheless, there is also criticism of certain deficits of these centres. Technology centres are rarely adequate to serve as incubators for companies of manufacturing industries. Manufacturers have often very special locational requirements (space, specific infrastructure, etc.) which cannot be offered by the centres. This leads to the dominance of service companies in these centres. Many technology centres have, due to their private character, restricted their activities to the administration of facilities and infrastructure (e.g., the technology centre in Linz). They are hardly engaged in further services like technology transfer or consulting, because they are neither sufficiently profitable nor paid by public institutions.

It has been recognized that some of the technology centres in Upper Austria have to broaden their support functions to improve their effectiveness in stimulating innovation and technology upgrading, but it is obvious that such additional functions have to be susidized. In order to avoid a regional lock-in-situation, technology centres will have to be mediators to sources of technological and market know-how beyond the region.

With regard to the special technology transfer needs of SMEs, the high concentration of support activities on large companies, universities, and certain subregions (especially Linz) is seen as a major problem. A few locations and firms are able to skim off most of the support offered. For SMEs to benefit from technology transfer, a more decentralized approach is needed.

A further problem of technology transfer in Upper Austria is the lack of adequate institutions. According to TMG, there are only three institutions which are performing this function to a significant extent: the Competence Centre in Ranshofen, PROFACTOR (which is a firm in the FAZAT Steyr) and the university of Linz. In the future the newly established technical colleges ("Fachhochschulen") could become important partners for technology transfer, especially for SMEs. At the moment, however, they are still confronted with the problem that too many of the teachers are not permanently working there but only part-time lecturers. Both teaching and research is negatively affected by this situation. Contract research is unlikely to become significant in such a situation.

One frequently mentioned strategy to involve SMEs into a technology transfer system is the support for the formation of clusters. The most important (potential) cluster in Upper Austria is the vehicle industry. Due to the fact that a major company in such a cluster (Steyr-Daimler-Puch) has locations both in Upper Austria and Styria, this strategy is presently being shared and to some extent coordinated with Styria. Other clusters might be plastics and wood, but they have not reached any stage of realization yet.

2.2 The technology, innovation and R&D infrastructure in Upper Austria

The regional technology centres are elements of the so-called "Upper Austrian Technology Network". The main elements of this technology- and innovation-related system are summarized in table II.6.

In Upper Austria there is one university located which comprises several science disciplines. The "Johannes Kepler University" is located in the provincial capital Linz. It has three faculties - law (13 institutes), social sciences and economics (24 institutes), and technology and natural sciences (25 institutes). In addition, it has a centre for correspondence courses. Referring to its position in the Upper Austrian technology network it performs the following functions: academic education, basic research, and contract research. Compared with the major university locations in Austria, the university of Linz is rather small. In 1997 there were 104 professors teaching approximately 14,000 students. These numbers represent 6% of professors and 7% of students of all Austrian universities. For example, the university of Vienna had 427 professors and more than 73,000 students in this year. Specialized universities like the Technical University of Vienna (180 professors and 22,000

students) and the Technical University of Graz in Styria (100 professors and 12,000 students) have in spite of their focus on technology still at least the same size as the comprehensive university of Linz. The second university which is located in Linz is specialized in "Art and Industrial Design". It is very small and its role in the technology and innovation system of the province is rather limited.

Table II.6: The key elements in the Upper Austrian technology infrastructure

Institution	*Location*
Universities, research institutions:	
Johannes Kepler University	Linz
University of Art and Industrial Design	Linz
Technical colleges ("Fachhochschulen"):	
Automated Plant and Process Technology	Wels
Manufacturing and Management Technique	Steyr
Media Engineering and Media Design	Hagenberg
Software Engineering	Hagenberg
Vocational training institutions:	
"Wirtschaftförderungsinstitut"	Linz
"Berufsförderungsinstitut"	Linz
Consulting, technology transfer:	
Technology and Marketing Corporation	Linz
Innovation Relay Centre Austria	Linz
Technology centres and science parks:	
Software Park Hagenberg	Hagenberg
Competence Centre for Light Metals	Ranshofen
Research and Training Centre for Labour and Technology	Steyr
Technology Centre Linz	Linz
Incubation and Technology Centre Wels	Wels
Technology Centre Innviertel	Braunau
Technology Centre Salzkammergut	Lenzing

In Upper Austria there are four technical college courses at three locations. Technical colleges have been established in Austria only recently. But the first experiences as far as training and education is concerned are very positive. In the year 1997 there were about 3,800 technical college students in Austria, attending 33 courses. The share in the number of students of the four courses offered in Upper Austria is 16%. In 1997, Wels ("Automated Plant and Process Technology") had 305 students, Hagenberg 143 in "Software Engineering" and 50 in "Media Engineering and Media Design", and Steyr had 102 students ("Manufacturing and Management Technique"). The demand from industry for graduates of these courses is very strong. On the other hand, contract research and development is only performed to a very limited extent at these institutions at present. This might change in the future, but it will certainly depend on a better funding. To improve R&D-activities, it will be necessary to employ more full-time teachers than today. Only then there will be enough manpower for significant R&D.

Vocational training institutions in Upper Austria are important providers of training programmes aiming at the practical needs of firms. But they are hardly engaged in performing additional functions like consulting.

It seems to be that the most important elements of the technology and innovation system in Upper Austria besides the companies are the technology centres. We are going to describe them now in more detail. We will see that they are not homogenous. To give a first overview, the technology centres in Upper Austria can be categorized in the following way:

Table II.7: Categories of technology centres and respective institutions in Upper Austria

Type and features	*Institutions in Upper Austria*
Incubation centre:	
Provision of infrastructure and services for start-ups for a restricted period of time (about 5 years).	Incubation and Technology Centre Wels Technology Centre Linz Technology Centre Innviertel Technology Centre Salzkammergut Software Park Hagenberg Research and Training Centre for Labour and Technology Steyr
Business park:	
Provision of infrastructure and services for manufacturing and service companies belonging to certain business fields.	Incubation and Technology Centre Wels Technology Centre Linz Technology Centre Innviertel Technology Centre Salzkammergut
Technology transfer centre:	
Information on available technologies, mediation of contacts between technology supply and demand, support for commercialisation of innovative technologies.	Innovation Relay Centre Austria (Linz) Research and Training Centre for Labour and Technology Steyr * Software Park Hagenberg *
Technology / innovation centre:	
Provision of infrastructure and services for technology-oriented ("higher-tech") innovative firms.	Software Park Hagenberg Research and Training Centre for Labour and Technology Steyr
Science park / research centre:	
Provision of infrastructure and services for institutions engaged in R&D, comprising companies (or their R&D-laboratories) and research organisations (incl. university institutes).	Software Park Hagenberg Competence Centre for Light Metals Ranshofen

* Technology transfer is done primarily by independent firms or research organisations located in these centres, not by the centres themselves.

In the following, we distinguish between two groups of technology centres: first, the centres with relatively intensive R&D-activities; second, those which are more or less providers of facilities with only little additional consulting activities.

2.2.1 The R&D-oriented technology centres in Upper Austria

The certainly most important institution belonging to this category is the **Software Park Hagenberg** (SWP), located closely to the capital Linz. It is a technology and research centre for software development and related services. It is exclusively focussed on the technology field "software". The SWP was founded in 1987. Originally, it was the initiative of certain institutes of the university of Linz to establish such a centre. At the beginning, it consisted therefore only of an external department of one institute of this university - the "Research Institute for Symbolic Computation" (RISC). But it soon expanded through the establishment of companies at this location. Formally, the institution started in 1992 adopting the name "Software Park". Since the early nineties the park has been continuously expanding. The SWP was planned from the beginning to comprise a mix of university institutes, companies and a technical college courses.

The reason to establish a research park outside the provincial capital was to compensate the relatively low wages (according to international standards) which can be paid for highly qualified researchers with the high quality of life in this area. The second reason was to establish new jobs in a region with weak economic performance.

The institution covers three functions in the process of innovation. It conducts research, offers training and is engaged in applied industrial development projects. Research is primarily done by the three institutes of the University of Linz which are partly located in Hagenberg. More applied research is also done by the technical college ("Media Engineering and Media Design" and "Software Engineering"), but only within a limited scope. Their main responsibility is training and education. As far as the university institutes are concerned, the activities in the SWP are concentrated on research projects. Applied industrial projects are primarily done by the firms in the park, but sometimes also by the university institutes. With regard to contract research there are some overlappings between firms, universities and training institutions. But this does not result in serious competition within the park. In fact, because all institutions are highly specialized, there are rarely conflicting interests. All present contract research activities sum up to approximately 100 projects.

As already mentioned, three insitutes of the University of Linz have external departments in the SWP. They split their activities in research and education between the SWP and the University of Linz. The academic staff in the SWP is primarily concerned with research, whereas teaching is done in Linz (but not exclusively). The typical way to organize scientific projects is to build teams around a permanent researcher at one of the three institutes. These teams normally consist of students working for their dissertation. The empirical part of their thesis refers to the project.

The dominant business activities of the SWP-firms belong to the fields software and industrial mathematics. And even the few other firms are mostly active in closely related fields (see table II.8). The companies in the park are predominantly very small. Most of them have up to three employees, some are even only one-person firms. The SWP has therefore important features of an incubation centre. Most of the firms are spin-offs of former research projects. In spite of the fact that these firms are young and small most of them are already well established. They have successfully passed the start-up phase. Besides these small companies there are only two larger

business institutions in the park. These are research laboratories of two major Austrian electronics companies (Siemens and AMS). They are subsidiaries, not autonomous organizations.

The financial sources of the SWP are numerous. University insitutes are funded by the federal university budget. Additionally, they earn money through contract research. In this case, the most important providers of funds are the big national institutions, primarily FWF and FFF (see chapter 1). The province also supports projects, but only to a very limited extent. The companies in the park have to pay for the infrastructure. Most of the funding of the park can be financed by the members of the park themselves. Nevertheless, the SWP receives subsidies from the province of Upper Austria. But they are only granted for specific investments in hard- and software and for certain technology, innovation, and research projects. To receive such funding, they have to compete with the other technology centres in Upper Austria. Therefore, the subsidies, in total, are rather low. For example, recently the SWP received 363,000 EURO (5 million ATS) provincial support for investments like an ATM-connection to the University of Linz which is necessary to be able to use the computing capacity of the University.

Currently, there are approximately 100 persons working in the SWP. This number comprises both the employees of the firms and the personnel of the research institutes. The technical college has about 300 students. Additionally, each of the university institutes has about 15 doctoral students working in research projects. In its first year, 1987, the SWP had only 50 employees.

The predominant network type of the park's organization, linking scientific institutes, research laboratories, firms, and the technical college, was a clear target from the beginning. The intensive interaction between researchers, engineers, managers and students is considered to be a very important adavntage of this organization. In this context it is important to note that competition between firms and institutes in the park is rare. In general, it is far more important for the institutions in the SWP to cooperate in order to succeed in receiving support for research projects. On an individual basis, at least the firms would be too small to be successful. Recently, the firms of the SWP have established even a formal association for joint project applications. Cooperation is not limited to the members of the park, of course. There are frequent cooperations with other Austrian universities and companies.

As far as buildings and facilities are concerned, the park is continously expanding. At the moment there is enough space in the village for the new projects. But the fast expansion of the park causes some organizational problems. At the moment the SWP has a very lean organizational structure. This could become impossible when reaching a certain size. Further, there are some problems to integrate a relatively large R&D-institution into a small village. The SWP has a students' hostel and most of the scientific staff lives in the village. This changes the social structure remarkably. In addition, social infrastructure like transport, restaurants and so on is still insufficient. But these problems could be handled so far. In this context, the good collaboration with the municipality is obviuosly very helpful.

The focus on software development will not be changed in the future. But it is intended to establish new areas around this core competence. This should comprise new firms, a third technical college course either for bio-engineering or risk analysis, which is not yet decided, and the establishment of

a “software competence centre”. Recently, the decision which competence centres will get federal support was taken. The SWP succeeded in the second call. If all the plans for expansion can be realized, the SWP should grow by 70 to 100 employees.

One of the first successful applicants for the status of a competence centre was the **Competence Centre for Light Metals Ranshofen**. This institution is part of the Austrian Research Centre Seibersdorf located in Lower Austria. The competence centre in Ranshofen is an external department of this research organization. Its research activities are concerned with new materials. It is one of the three winners (out of six applicants) in the first call for the status as a competence centre. This status is important, because it is linked to the federal “K+ programme”. This is one of the new national technology and innovation support programmes administrated by the ministry of science. The overall support volume for the competence centres is 10.9 million EURO (150 million ATS) for the next 4 years. Because this institution is very young, its effects on the Upper Austrian R&D-infrastructure can hardly be assessed today.

Already well established is the **Research and Training Centre for Labour and Technology Steyr** (FAZAT). This centre is located in one of the old industrial areas of Austria - in Steyr. The last company at the centre's location stopped its manufacturing activities in 1980. Until 1987 this area was fallow land. This period was also a time of serious economic problems in the region of Steyr. This was partly caused by the crisis of a major Austrian company of the vehicles industry - Steyr-Daimler-Puch. In the late eighties, the area was revived for an exhibition about “labour and economic development”. In this context the idea of a technology centre in Steyr was born. The end of the eighties was a very dynamic time in Upper Austria regarding economic restructuring. Strong positive effects resulted from the establishment of a BMW-subsidiary in the region. Finally, the FAZAT was founded in 1989. The original plan was to establish an incubation centre. But the concept was soon broadened leading to the more ambitious project of a technology centre with a technical college.

The FAZAT itself - the centre administration - is not only restricted to the centre management. It is also active in regional development and location marketing. Its consulting activities deal with the attraction of firms to the region and with the support for start-ups and for existing companies regarding technological and organizational improvements to enable growth. These are sensitive activities because of the intensive competition between regions, also within the province of Upper Austria, to attract companies. As far as the consulting activities of the FAZAT are concerned, there are close cooperations with the regional institution TMG and national institutions which are engaged in supporting start-ups and the establishment of business parks. These cooperations are especially important in the case of international marketing activities, beyond the regional focus of the FAZAT.

Automation and telematics dominate the activities of this technology centre. In the field of telematics, one of the current projects is the development of a Intranet-based location information system. The objective of this project is to speed up the process of finding an adequate location. Inquiries of firms can then be handled electronically by the municipial authorities. Another very important telematics application is the "Regional Information System" (RIS). The RIS is a spin-off of the FAZAT, now organized as an independent company and probably leaving the centre soon. It

is the strategy of the FAZAT to develop new ideas until the concept for application. Then the initiative has to be run as a separate organization and - also due to the scarce space at the location - after some time should relocate. There are two further spin-offs - a consulting and development company (Kappa, 20 employees) and a small multimedia company. In former times the FAZAT hosted also a technology centre of a large Austrian company in the automotive industry (Steyr-Daimler-Puch), but the centre has been already relocated.

The most important technological focus area, though, is process automation. There is a very successful organization located in the FAZAT which is performing engineering and contract research in this field - PROFACTOR. This non-profit organization is part of the institute for flexible automatisation of the Technical University of Vienna employing 30 persons - engineers and scientists. It is active in international research projects in the field of advanced production technologies (especially robotics) and applied projects with companies.

The FAZAT hosts one of the four technical college courses in Upper Austria - "Manufacturing and Management Technique". This institution has about 80 students per year. The first 50 to 60 will finish their studies this year. Due to the fact that this institution is very young, it cannot be assessed at the moment how well the training matches the needs of the firms and to what extent the students will stay in the region. According to studies done before the establishment, the expectations are very optimistic that the students will easily find jobs. The basic orientation of the training programme focusses on general skills combining production and management and stresses social competence and language skills.

The function of technology transfer is done primarily by PROFACTOR and, to a lesser degree, by the technical college. Most of the firms to which technology is transferred are large companies which are located in the region (e.g., BMW) as well as in other parts of Austria. There are less relations with SMEs, and if there are relations they are mostly restricted to the region around Steyr.

For the establishment of the FAZAT most subsidies were provided by the municipality of Steyr. PROFACTOR has received further subsidies for infrastructure and equipment by federal, provincial and EU-institutions. To a lesser extent the province of Upper Austria and federal ministries have provided subsidies. Nevertheless, in the early years of the centre the federal subsidies were significant (42% of the total investment costs between 1990 and 1994), but they have decreased in relative terms since then (17% at present). Due to the increasing investment volume, however, the federal contribution has risen to 1.2 million EURO (17 million ATS) in 1998 (ÖIR, 1998). As far as the operation of the centre is concerned, institutions of the centre are supported differently. At the moment the FAZAT receives 50% of its expenses as subsidies. The other half has to be earned through contract research and consulting. The public share is continuously decreasing. The share of contract research is similar in the case of PROFACTOR, it is only the type of client who differs. In contrast to FAZAT, the clients of PROFACTOR are mainly private companies. In the case of the technical college there is a general federal contribution of 6,900 EURO (95,000 ATS) per student per year. The rest has to be financed by the municipality of Steyr and the province of Upper Austria.

The FAZAT is considered to be quite successful. Partly this can be explained by the fact that all political groups and the municipality of Steyr supported this project. The technology centre is still

widely accepted and appreciated. Another strength is the intensity of cooperations within the technology centre, especially between FAZAT, RIS and PROFACTOR.

The FAZAT has developed a concept for a business and service park at another location in Steyr. For a larger-scale business park there is too little space at the present location. This park should be also the location for further FAZAT-spin-offs. The park should comprise a mix of manufacturing and service firms and research laboratories of big companies like Siemens or BMW. Significant incubation activities at the present location are impossible, therefore an additional business park seems to be necessary. Nevertheless, the decision has to be taken yet.

With regard to the fields of technology, the FAZAT might start activities in the new field of environmental technologies in the future. It is also planned to add a second technical college course "Business and Trade" focussing on logistics and distribution. Further, it is intended to offer distance learning programmes for working people via telematics. A cooperation with the German “Fern-Universität Hagen” is already established in the FAZAT.

2.2.2 The facility-oriented technology centres in Upper Austria

At present, there are three big technology centres in Upper Austria which are more or less facility-providers. They are located in Linz, Wels and Braunau. Recently, a new technology centre in Lenzing has been established, but it is still very small. Because of their functional similarity, it will be sufficient to describe one of them in detail and to restrict the description of the others to additional details.

The **Incubation and Technology Centre Wels (GTZ)** is the second largest centre in Upper Austria. This in spite of the fact that the GTZ is a young institution. It was established in 1996. As a consequence the centre is still in the phase of development. The centre is run by a separate company owned by the municipality of Wels (35%), a regional energy supplier (20%) and several banks (45%).

The GTZ is an incubation centre which provides infrastructure for small young firms. Most companies are service firms. Telecommunication and related fields like software, information technologies are predominant (see table II.8). Some firms are also engaged in higher-tech fields like automation and food chemistry. But in general, the technological level of the firms is not very advanced. In fact, the GTZ concentrates on “simple” but widely applicable technologies, especially in the field of telematics. This means that an important role of the technology centre is training in such technologies. This, according to the centre manager’s view, would enable firms to find market niches or to gain competitive advantages without any high-tech-ventures.

Beyond facility management, the GTZ intends to support or initiate technology transfer between the firms in the centre, but in an unorganized way. The GTZ is definitely not a technology transfer agency. It has to be considered that the staff is very small, the centre management has only four employees. To make up for this lack of manpower, external consultants are used.

The few own consulting services of the GTZ are related to problems of start-ups, the structural improvement of firms and the application for R&D-support. The GTZ offers to its firms marketing and PR services and information events. They offer also consulting how to apply for (primarily federal) R&D-project support. Most SMEs need help to manage the administrative procedures.

The GTZ offers some of their services also to firms outside the centre. This applies for example to the information events on R&D-funding. In addition to the centre services, the GTZ is also engaged in urban and regional development planning.

The GTZ has to be more or less self-supporting. It receives only very small subsidies of the chamber of commerce to support the adminstrative costs of the centre (approximately 36,000 EURO (500,000 ATS) per year). In addition, technology-oriented firms in the centre receive subsidies for renting office space. Some innovative projects receive subsidies, mainly provided by the FFF, but these are only few cases. They deal with food chemistry, energy technology and data processing.

An important barrier for subsidies is the fact that the region of Wels is not a target area for structural funds. This means that many support programmes like RIP (see chapter II 3.4) are not applicable. The GTZ is primarily controlled by private investors, politics and public institutions play a minor role.

In supporting its firms the GTZ follows a cooperative approach. All activities should be done with partners, both private and public. Frequent cooperations exist with the chamber of commerce and some banks. Overall, interactions with private firms are more frequent than with public institutions. The GTZ has also close links to the technical college located in Wels which offers a course on "Automated Plant and Process Technology". In this context, it has to be mentioned that the regional effects of this institution are rather weak. Most firms cooperating with this institution are located outside the region, many students leave the region after their studies.

The performance of the centre is satisfying as far as its role as an incubation centre is concerned. Regarding start-ups, the number of new firms has exceeded the expectations. All firms in the GTZ come from the close surroundings of Wels. All of them are very small at the moment having between 2 and 4 employees only. But this is not surprising, if one considers the fact that the centre has been established only 2 years ago. The centre management is satisfied with the expansion since 1996. A further physical expansion is neither considered reasonable nor feasible. Instead of the enlargement of the centre's capacity to host new firms, the organization shall become a "virtual" technology centre, offering more services also to firms outside the centre. Services shall be provided via telecommunication technologies. The need for office space will probably even decrease in the future due to the rising importance of teleworking.

As far as technology transfer is concerned, the performance of the centre is weak. As mentioned before, the institution is not actively engaged in technology transfer services. We found a very sceptical view of the centre management regarding the effectiveness of technology transfer. According to them, the most serious barriers are the lack of consciousness of the importance of technology deficits on the side of technology-demanding firms, high costs of the transfer and

communicative problems between business and science. On the side of technology-offering organizations (both universities and firms) there would often be a fear to lose know-how and a general lack of willingness to cooperate in Austria due to cultural specificities. Additional problems would arise in the case of universities, because there are no incentives to engage in transfer activities.

This impression is further confirmed that the experience of the GTZ regarding information on R&D-funding opportunities is rather bad. In general, there is little feedback on information on such issues. This lack of interest is not restricted to the firms in the GTZ. The number of technology-oriented firms in Upper Austria seems to be too small in general. Demand for R&D-support comes predominantly from the few large companies in Upper Austria. Most SMEs seem to be service- but not technology-oriented.

The fact that the largest centres in Upper Austria are not performing technology transfer functions is a serious deficit in the technology and innovation system in Upper Austria. The largest centre, the **Technology Centre Linz** (TZ-L) offers only infrastructure and basic facility services. Additionally, it organizes meetings and events offering adequate seminar rooms and the relevant equipment. After its privatization it is not engaged in any further technology-related services. The fact that this location still has some importance in the technology transfer system in Upper Austria is mainly due to the Innovation Relay Centre (see below) which has its office in this centre.

The situation is similar in the case of the **Technology Centre Innviertel** (TZ-I) located in Braunau. The provision of infrastructure is the primary function of this centre. Contrary to the centre in Linz, it offers some additional consulting services like measurement technologies, quality management, application for R&D-project-support, and database and patent inquiries. An additional special feature of this centre is its location at the border to Germany and the Austrian province of Salzburg. Therefore the centre has to some extent a border-crossing function for Upper Austria. But this should not be exaggerated. The centre, in spite of a continuous expansion, is still small. Today it has 28 firms, only 5 are German companies. This centre has received substantial federal subsidies which covered 40% of the investment volume of the first phase and 26% (0.5 million EURO, 7.5 million ATS) of the present phase since 1997 (ÖIR, 1998).

The most recently established centre is the **Technology Centre Salzkammergut** (TZ-S), located in Lenzing. This “Techno Park” is still in the phase of foundation. At present there are only 7 firms in this centre. Currently, there are plans for four new technology centres in Upper Austria. They will be located in Ried, Gmunden, Enns/St. Florian, and Freistadt. It remains to be seen, if all of them will be able to play a relevant role in the technology transfer system in Upper Austria. The experience so far does not support this view. In fact, it is not consistent to the technology strategy formulated in the concept “Oberösterreich 2000+” (TMG, 1998), already described above (see chapter 2.1 of part II), where the improvement of the existing centres is given priority over the setting-up of new centres.

The following table summarizes the number of firms located in the Upper Austrian technology centres and the sectoral composition:

Table II.8: Firms in the Upper Austrian technology centres

Technology centre	*Number of firms*	*Business activities*	*% of all firms*
Software Park Hagenberg	27	Software, industrial mathematics	61.9
		Engineering	14.3
		Consulting	14.3
		Automation	4.8
		Manufacturing	4.8
Research and Training Centre for Labour and Technology Steyr	6	Information systems, software	50.0
		Automation, CAD/CAM	33.3
		Engineering	16.7
Technology Centre Innviertel	28	Consulting	36.7
		Automation technologies	23.3
		Engineering	23.3
		Software	10.0
		Quality management	6.7
Incubation and Technology Centre Wels	39	Services	23.8
		Data processing, software	14.3
		Environmental, energy technologies	14.3
		Information, telecommunication tech.	9.5
		Electronics	7.1
		Engineering	7.1
		Construction	7.1
		Other activities	16.7
Technology Centre Linz	46	Software, information systems	32.6
		Consulting	15.2
		Engineering	13.0
		Trade	13.0
		Automation	6.5
		Testing, measuring, quality	6.5
		Pharma, medical products	6.5
		Other activities	6.5
Technology Centre Salzkammergut	7	Software	42.9
		Electronics, automation	28.6
		Engineering	14.3
		Trade	14.3

2.2.3 Technology transfer in Upper Austria

We have already mentioned that there is no central technology transfer agency in Upper Austria. Nevertheless, a part of its functions is performed by the **Innovation Relay Centre Austria** (CATT)

located in the technology centre of Linz. Of course, some transfer services are also offered by institutions like the SWP and the FAZAT (see chapter 2.2.1 of part II). Nevertheless, there is only the CATT which really focusses on certain aspects of technology transfer.

The CATT is the Upper Austrian partner of the Innovation Relay Centre Austria (IRCA) which is a member of the network of the European Innovation Relay centres. Besides general information on technology cooperations accessible for all firms, the CATT offers special services to companies which are members. The tasks of the CATT are:

- Identification of technological needs of firms
- Introduction of new technologies
- Commercialization of innovations
- Transfer of innovative technologies and results of research
- Mediation of cooperation partners

The CATT offers consultancy for active and passive technology transfer. For these purposes it performs the following services:

- Information collection and distribution on technologies and firms
- Search in databases (especially CORDIS)
- Information on funding programmes
- Support for project applications
- Mediation of contacts to cooperation partners, already existing networks and funding programmes (especially EU)

To some extent the CATT is therefore performing transfer services. But it is more an information provider, not a consultant. Its perspective is the European innovation exchange network, not regional technology providers. This is one of the reasons why in the strategic technology programme (TMG, 1998) it is considered necessary to establish a new transfer agency at the University of Linz (see chapter 2.1 of part II).

3 Effects of direct technology and innovation support programmes in Upper Austria

In this chapter we deal with the most important direct innovation support instruments, especially concentrating on the benefits for Upper Austrian companies. We will analyze three national programmes - FFF, ERP and ITF - and a special joint national/regional programme - RIP -, all of them providing direct support for innovation and R&D-projects. They are the most relevant instruments according to our research objectives. This is due to the fact that the science, technology and innovation support programmes in Austria are institutionalized along major phases of the innovation process. The four selected instruments aim at applied research, development and commercialization. In this context the term ‘commercialization’ is referring to the transfer of a prototype into regular production (“Fertigungsüberleitung”). Basic research is supported by a fourth fund - the FWF. We will not deal with that institution, because it is primarily aiming at universities and therefore of relatively little importance for firms’ R&D. The RIP is a joint programme of the

state of Austria and most of its provinces supporting the economic recovery of old industrial regions and structural improvements and economic growth of peripheral regions, especially (but not exclusively) through innovation. This programme is administrated by the ERP.

3.1 Austrian Industrial Research Promotion Fund (FFF)

The "Forschungsförderungsfonds für die gewerbliche Wirtschaft" (FFF), located in Vienna, exists since 1968. The FFF supports research and development projects of firms. It concentrates on the early phases of the innovation process, i.e., research and development of prototypes. Occasionally, the FFF supports the commercialization of a prototype, but this belongs normally to the tasks of another Austrian fund - the ERP (see chapter II 3.2).

Recently, the FFF (1997) has formulated several objectives and strategies (so-called "Aktionslinien") for their support activities:

- Support for international research cooperations which accounted for 12% of the FFF-funds (grants and loans) and projects in 1997.
- Contribution to strategic large-scale projects. In 1997 there were only two projects but they required 5% of the funds provided by the FFF.
- Support for SMEs. The FFF defines this category rather broadly with an upper limit of 500 employees. Nevertheless, even if one uses the limit of 250 employees, this group already accounted for half of the funds in 1997.
- Special focus on industries which are important for the Austrian economy, but perform little R&D. At present, there is a focus on the timber industry, accounting for 6% of the FFF-funds in 1997.
- Support for R&D-activities of Austrian subsidiaries of international companies. Some international companies are interested in intensifying research in Austria. Nevertheless, today there are only 2 projects having received 5% of funds in 1997.
- Upgrading of suppliers from selling components towards suppliers of systems. These activities accounted for 10% of funds and 7% of projects in 1997. So far, they are restricted to the vehicles industry.

The impression is that SMEs are not the primary target of the FFF-support activities. Most interesting according to the interactive innovation model are the first and the last strategy - international research cooperations and systems supplying. It seems that the new innovation concepts are gaining importance in the strategic considerations of the FFF.

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 any technology focus areas (with the exception of one small sub-programme referring explicitly to wood technologies). The arguments in favour of this bottom-up-approach is that it would be difficult for any support institution to recognize fast enough the opportunities for innovation in a variety of technological fields and markets. Often windows of opportunity would be missed because of slow reaction. Further, many focus areas would be unsuccessful, because there were not enough firms which are interested or have the required capabilities. Additionally, the funds

earmarked for any focus area would be too small to gain the critical mass. Nevertheless, the FFF is not indifferent with regard to technologies and levels of innovativeness. In fact, the FFF focusses on "high-tech"-projects. They concentrate support on high-risk projects of development and innovations which are more than incremental. As far as SMEs and start-ups are concerned, projects which improve the technological level of these firms significantly are 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 in 1996/97), pharmaceutical technologies (9% of funds and 2% of projects in 1996/97), and advanced materials (7% of funds as well as of projects in 1996/97).

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. The ministry is not represented in this board. This might change in the future.

As mentioned at the beginning of this chapter, the basic structure of the Austrian R&D and innovation support system is designed in a way to avoid redundancies. Basic research is the task of the FWF, industrial applied research and development of the FFF and the commercialization of innovations is the task of the ERP. There are many and frequent contacts between the funds to keep this distinction functional. Applications are redirected, if they are inadequately addressed. Collaboration is also necessary to check, if one firm applied for the same project several times at different funds.

The financial resources of the FFF consist of funds of the federal government, funds of other public institutions, and repayments of loans. Recently, EU-programmes are gaining importance as additional source of funds.

Table II.9: Support method/instruments of the Austrian Industrial Research Promotion Fund

	FFF
Financial instruments:	Mix of non-repayable grants and low-interest loans
Financial conditions:	Flexible, at present (6/98) 3% p.a., 2 years redemption-free
Time period of support:	Dependent on the project, credit period on average 5 years
Applicable projects/costs:	Personnel and capital costs (research equipment), external training, consulting, contract research
Maximum contribution:	50% of the total costs of the R&D-project
Requirements for applicant:	Company, researcher or inventor located in Austria
Necessary firm features:	None

Source: FFF

The FFF uses a mix of three instruments: 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 resulting net subsidy-value of a FFF-loan is approximately 12%. 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 innovation project which results in a far reaching technological advance receives a higher percentage of the support in the form of grants. In 1997 the FFF provided 58.8 million EURO as grants, 79.0 million EURO as loans, and 31.4 million EURO as guarantees.

In the past years, guarantees have gained relative importance, the share of loans has decreased slightly, whereas the share of grants has remained rather constant. Due to the mix of different support instruments in all projects, it is interesting to calculate the net subsidy-value. Overall, the net value of the FFF support activities is slightly more than 50% of the provided funds. In 1996 it was 52.9%, in 1997 only little less (51%).

The limit to what extent a project is going to be supported by the FFF is 50% of the project volume. The other half has to be financed by the applicant himself. The projects are evaluated according to a fixed rating procedure. There are four groups of criteria with different weights. The groups contain the following criteria:

- Novelty, R&D risk, functionality, ecological relevance
- Technological up-grading, R&D dynamics, feasibility
- Economic performance, dynamics (growth of the firm)
- Marketing experience, marketing perspectives, commercial implementation of results, macroeconomic effects, social aspects

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 to 8 weeks. This is relatively fast compared with the practice in other countries. The primary evaluation might seem superficial, but the FFF has two possibilities within one 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 support 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 technical respect, then it is possible to transform loans into grants. This is not possible in the case of a commercial failure.

As a special focus, the FFF stimulates R&D-cooperations with universities, research organizations, technical colleges, and students working in the firm for their dissertation and being paid by the FFF using the same instruments as in the case of the direct support for R&D-projects. This can be seen as a move towards the interactive innovation model as the underlying concept for support activities. But so far, only the response to the support programme for students is satisfying, both by universities and students and by the companies. The cooperation-programme ‘science - industry’ has been used rather weakly. The stimulation of such cooperations seems to be easier in theory than in practice. Even in spite of the fact that firms can get a better support mix (i.e., a higher share of grants leading to a higher net value), if the cooperate with universities, the number of cooperation-projects is negligible.

In general, the supporting activities of the FFF are very homogenous. By far most of the funds and projects belong to the standard programme, described above, which is still dominated by the linear approach to innovation. In addition, there are some special sub-programmes, but they are clearly

less important. Together they accounted for less than 10% of the total budget in 1997. Only two of these instruments are funded by the FFF itself: the special R&D-programme for the wood-industry and the support for junior staff ("Nachwuchsförderung"). Two others are administrated by the FFF, but funded by Austrian ministries. These are the so-called "impulse-support" programmes for cooperations of firms with research organizations and technical colleges.

The support programme for junior staff has been recently evaluated (Hanel, 1997). This instrument supports diploma and dissertation theses of applied character in cooperation with firms. Regularly, the students receive 50% of their costs in the form of grants (in the case of SMEs, they can get 363 EURO (5,000 ATS) per month), the firms receive 50% of their project costs in the usual mix of grants and loans. In 1997 39 projects were supported, representing a support volume of 4.4 million EURO (60.8 million ATS). The main results of this evaluation are:

a) The firms aimed primarily at recruiting. New ideas (innovation impulses) from the students and cheap research capacity only rank second and third. Recruiting was also clearly the main benefit, new ideas were little important. Nevertheless, the specific technical objectives were in most cases achieved. The success in economic terms was comparably far less satisfying. With regard to longer term consequences, the study shows that the FFF-supported cooperation projects were often successful in stimulating new projects, both internal projects of the firm and projects in cooperation with universities.

b) The students were, similar to the firms' intentions, most interested in finding a job. This goal was followed closely by earning money. It is interesting that these goals were mostly achieved. The chance to realize own ideas, however, was clearly less important. To do research and to gain job experience were of negligible importance. In general, the personal benefit was not assessed to be too high. The main benefit was seen to be on the side of the firms and the universities. About 40% of the students planned to enter into new research cooperations, but only about 20% were interested in starting an own project. Further contacts with the firm after the end of the project could be found in the case of more than 60% of the students, 30% were employed immediately after the project.

Table II.10: General support statistics of the FFF

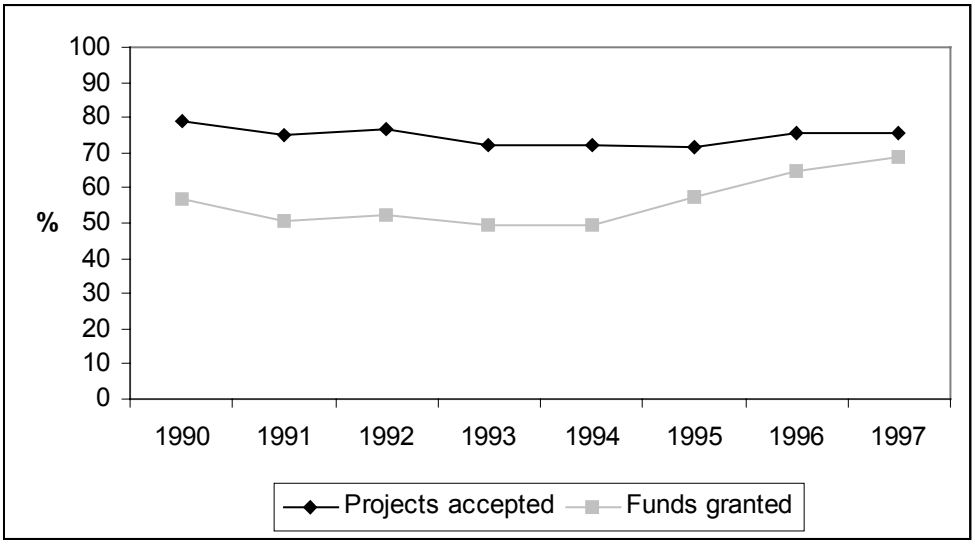
	Projects applied	*Projects accepted*	*Funds applied (million EURO)*	*Funds accepted (million EURO)*
1990	672	529	141.9	80.5
1991	620	465	149.4	75.3
1992	804	616	177.6	92.9
1993	970	702	226.2	111.2
1994	884	636	207.8	102.2
1995	964	691	208.3	119.5
1996	940	711	211.9	136.6
1997	1007	763	246.8	169.1

Source: FFF

There has been a significant growth since 1990, stronger in applications for projects (+49.9% 1997 compared to 1990; +5.9% average increase per year) than in the acceptance of projects (+44.2% 1997 compared to 1990; +5.4% average increase per year). It is interesting that the amount of applied funds (+74% 1997 compared to 1990; +8.2% average increase per year) increased less than the total of the accepted funds (+110.2% 1997 compared to 1990; +11.2% average increase per year). Of course, the data on funds include inflation, a part of the increase is due to the continuous rise of nominal values.

The following figure shows that the rate of acceptance of applied funds has risen considerably since 1994, whereas the rate of acceptance of projects remained more or less the same. Obviously, many firms have become more realistic regarding the estimated project costs.

Figure II.3: Rates of project and funding acceptance of the FFF



Source: FFF

Austrian provinces have the possibility to co-finance FFF-projects which are done in their region. The advantage for them is to avoid an own evaluation and controlling procedure. If they do this by themselves, there are frequent failures because of a lack of the required know-how in the regional bureaucracies. Nevertheless, Upper Austria is not participating. The provincial government is not convinced that co-funding would lead to any additional R&D-activity and wants to save their funds for other support purposes.

Nevertheless, as the following table shows that the share of Upper Austrian firms in receiving FFF-support is very high:

Table II.11: Share of Upper Austrian firms in R&D-projects and -funds provided by the FFF

	Projects (%)	*Grants, loans (%)*
1990	-	29.0
1991	20.4	23.3
1992	21.1	20.8
1993	20.4	22.1
1994	21.2	24.0
1995	22.7	21.7
1996	21.7	23.0
1997	23.3	23.2

For comparison: The share of Upper Austria in the national gross product of manufacturing was 22.4% in 1993.
Source: FFF

The average funds provided by the FFF per project has increased especially since 1995. This applies both to Austria in general and Upper Austria in particular. Regarding the amount, there is little difference between the national and the provincial figures.

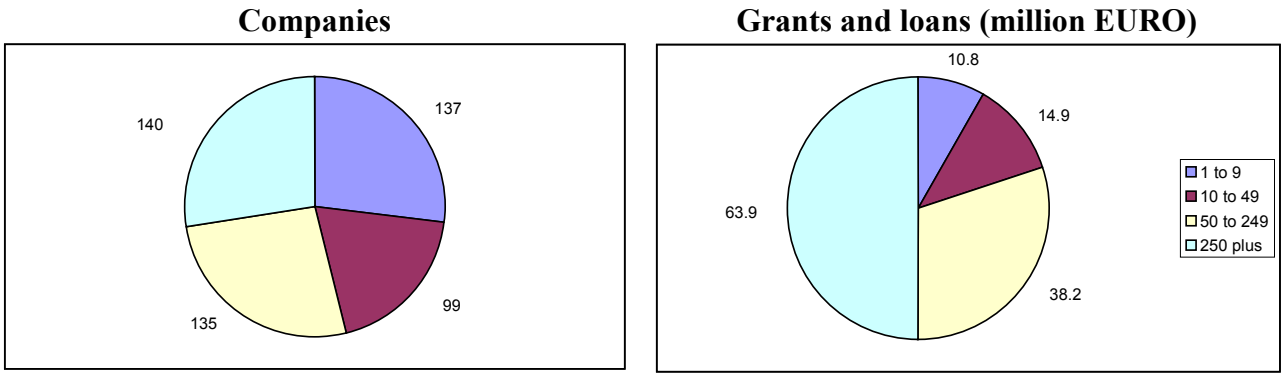
Table II.12: Average FFF-grants and loans per project

	Austria (1000 EURO)	*Upper Austria (1000 EURO)*
1990	152.1	-
1991	162.1	184.4
1992	150.8	148.7
1993	158.4	171.3
1994	160.7	181.5
1995	147.9	141.2
1996	169.1	179.8
1997	180.4	179.2

Source: FFF

The FFF has no special target groups within the economy, neither differentiated by industry, nor by size, nor by region. Nevertheless, small and medium-sized firms account for nearly 75% of the supported firms (see figure II.4). One reason for the quite satisfactory representation of firms with less than 250 employees might be that large firms are more interested in tax allowances which would account for much higher reductions of expenditure (due to the large R&D-budgets) than the relatively small amounts the FFF is able to grant. Usually, the support for SMEs covers a higher share of the R&D-project volume than in the case of large firms. Nevertheless, it should be considered that in terms of the size structure of the Austrian economy, SMEs are still underrepresented.

Figure II.4: Distribution of the FFF-support differentiated by firm size in 1997

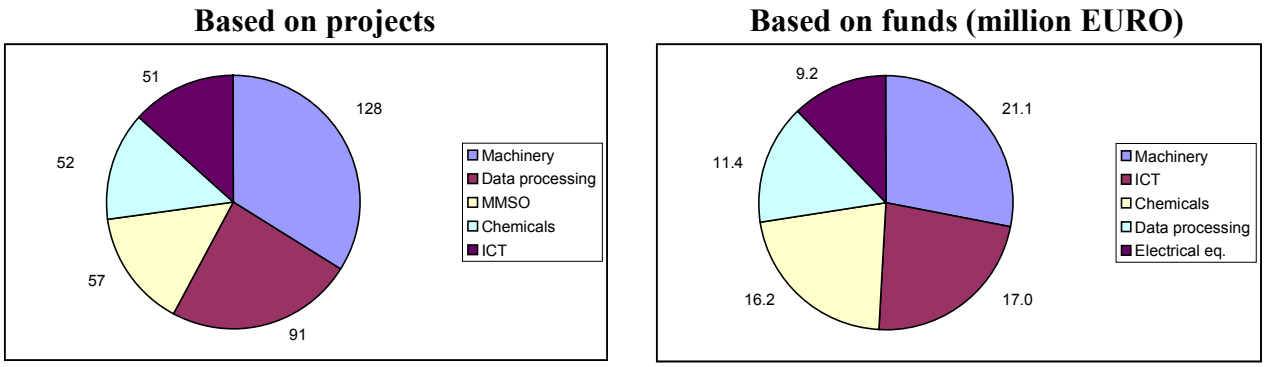


Source: FFF

The FFF is a well known institution in Austria. Therefore active acquisition is not considered necessary. In fact, some project applications have to be refused because of a lack of funds. In former times this was different, the FFF had to look for interested firms. Nevertheless, there are some information activities like "information days" in the Austrian provinces, regular contacts via the regional chambers of commerce and the dissemination of information about successful projects. Mostly, though, the exchange of information takes place between interested firms and firms currently working on a FFF-supported project. That many companies have established a long-term relation to the FFF can be seen by the fact that approximately half of the applicants per year had already been supported by the FFF before (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 "higher-tech"-oriented and continuously innovating. 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 significantly.

Which industries are benefiting most from the FFF-programme? Figure II.5 shows that most firms are in the machinery industry. This industry and chemicals are also very important in Upper Austria. The other industries are "high-tech". Their share in the Upper Austrian economy (as in other parts of Austria) is of course far lower than in the structure of the FFF-support. Some industries like metal products, textiles, furniture and food are surprisingly little represented in the structure of the FFF-support. Considering the fact that these are important industries in Upper Austria (and in other parts of Austria) we find that a significant part of the regional economy is obviously not R&D-oriented enough to take part in this support programme.

Figure II.5: The most important FFF-supported industries in 1997



MMSO = Medical, measurement, systems, and optical technologies

ICT = Information and communication technologies

Source: FFF

The management of the FFF seems to be quite satisfied with the performance of the programme. To some extent this can be supported by a recent study (Institut für Gewerbe- und Handwerksforschung, 1997) of so-called "technology-oriented" start-ups. The sample was based on addresses of the FFF. Therefore, some of the findings are relevant to assess the effects of FFF-support activities. The study only deals with start-ups, so the results cannot be generalized for all firms receiving FFF-support. But for this subset of FFF-firms the study shows that most of these firms were rapidly expanding (in terms of employment). But the data show also that the FFF-support was not decisive for all of these successful start-ups. The majority (53%) assessed the support by the FFF as necessary, but for 39% it was "only" important in the sense of "additional". For 8% support was not necessary.

The most important deficit mentioned by the FFF is a lack of systematic formulation of goals to be achieved by the support activities like establishment of new firms, stimulation of additional employment, increase of value added, stimulation of a continuous innovation process, and so on.

3.2 Technology programmes of the ERP-Fund

The "ERP-Fonds" is a very large technology support institution in Austria. It provides a range of several programmes. For the context of the SMEPOL-project two programmes are primarily relevant: the "Technology programme" and the "SME-Technology programme".

The ERP is an institution with an independent legal status. It is integrated into the Ministry of Science but forms a separate organizational entity. ERP-loans are provided out of the assets of the fund. The assets are kept stable through the continuous repayments of the loans. Additional funds from the federal government are very rare as far as the primary ERP-activities are concerned. In addition to these primary funding activities, the ERP is also in charge of the administration of special national programmes like RIP and ITF (see the chapters 3.3 and 3.4 of part II). In these cases the ERP administrates additional financial resources coming from federal and/or provincial budgets.

The ERP focusses on the transfer of prototypes into regular production. It aims at the support for technology adoption and implementation and the required development activities. It is not concerned with reseach which is the focus area of the FFF and the FWF. The general technology programme makes no distinction between firms of different size classes. Support in this programme is mostly concerned with capital and personnel costs. The second programme, on the contrary, is only accessable for SMEs according to EU-standards (up to 250 employees). Support in this programme is granted for investments. Neither of both technology programmes differentiates between industries or sectors. Only in the case of sectors with surplus capacities, firms belonging to such sectors have worse chances to receive support. Further, there is no explicit regional focus in both programmes.

The ERP provides exclusively loans at low interest rates. Loans are considered to be an adequate method to support investments and technology adoption costs, because the risk is low in these cases, whereas the support of R&D-projects which are usually confronted with a higher risk should be done better by direct grants.

The interest rates of the loans provided by the ERP is kept below the usual market rates. The difference between market interest rates and the ERP rates is only readjusted, if significant market fluctuations occur. But there are no fixed rules or points in time for such adaptations. Usually, adjustments take place about once a year. All major changes of ERP-conditions have to be notified to the EU which is an additional barrier to rapid changes.

On average the upper limit of ERP-loans restrict the part of a project or investment which can be supported to 50% of the total volume. In some cases of significant economic importance, though, this limit can be increased remarkably, in a few cases even up to 70%. The usual reason for raising the limit is the estalishment of a significant number of new jobs. But on average, only 25% - 30% of the total project costs basically accepted for support are actually supported by loans.

Most projects or investments which are applied for support are actually supported to some extent. This seems to be strange, but it has a remarkable reason: The ERP has normally no direct relations with firms. Contacts are mediated by certain banks (so-called “Treuhand-Banken”). They play an important role in the process of application. They are regularly the first contacts of firms looking for support. Few firms think explicitly of the ERP (or any other support institution) when they look for subsidies. The bank checks the project and decides, if it is reasonable to apply for ERP-loans. Already at this stage, projects which are unlikely to have a chance to receive support are stopped. This means that the ERP does not or only in very few cases receive inadequate project applications. The only decision prepared by the ERP concerns the share of ERP-support in the total volume of the project. For this purpose there are certain criteria, but they are not precisely defined. It seems to be more or less a “rule-of-thumb-procedure”. The final decision is taken by a commission (“ERP-Kreditkommission”) which consists of representatives of the political parties in Austria. But the actual importance of this commission is rather low. Usually, the prepared proposals for support are accepted. The average period of time to decide on a project support application is two months. In the case of larger projects, it can be as long as 4 months.

Table II.13: Support method/instruments of the two most relevant programmes of the ERP-fund for technology and innovation support

	ERP - Technology programme
Financial instruments:	Low-interest loans
Financial conditions:	Flexible, at present (7/98) 2.5% p.a. in the redemption-free period, 4% p.a. afterwards
Time period of support:	8 years, 3 years redemption-free
Applicable projects/costs:	* Costs of R&D-personnel * Running costs for R&D-inputs (e.g. materials) * R&D-related external costs (consultancy, patents, etc.) * Costs of equipment, instruments, and buildings used for R&D
Maximum contribution:	50% of the total costs of the R&D-project; 7.3 million EURO (100 million ATS) per year
Requirements for applicant:	Company with operating location in Austria
Necessary firm features:	None

	ERP - SME-Technology programme
Financial instruments:	Low-interest loans
Financial conditions:	Flexible, at present (7/98) 2.5% p.a. in the redemption-free period, 4% p.a. afterwards
Time period of support:	8 years, 2 years redemption-free
Applicable projects/costs:	* Investments in machinery, hardware, and software * Construction (building, etc.) * Costs of land (development) in the case of start-ups * Immaterial investments (technology transfer) * External costs (consultancy, feasibility studies, etc.)
Maximum contribution:	50% of the total costs of the R&D-project; 7.3 million EURO (100 million ATS) per year
Requirements for applicant:	Company with operating location in Austria
Necessary firm features:	SME according to EU definition: * No more than 250 employees * Either annual sales not more than 40 million EURO or total balance not more than 27 million EURO * No more than 25% of the capital owned by one or more non-SME firms (exceptions are public organizations and scattered ownership)

Source: ERP

The key data of the two technology programmes and the overall funding activity of the ERP are summarized in the following table II.14:

Table II.14: General support statistics of the ERP - in total and the two technology programmes

	ERP total			Technology programme			SME - Technology programme		
	Projects	*Project volume (million EURO)*	*Loans*	*Projects*	*Project volume (million EURO)*	*Loans*	*Projects*	*Project volume (million EURO)*	*Loans*
1990	193	1109.5	272.8	25	172.0	38.8	17	38.6	11.3
1991	184	920.9	273.7	28	193.1	57.0	29	88.6	26.3
1992	187	888.7	308.9	28	256.5	79.0	39	79.0	30.4
1993	161	933.8	342.5	49	395.1	134.6	31	114.2	52.0
1994	175	727.7	328.6	33	201.6	88.9	42	105.5	52.5
1995	204	985.0	410.9	44	148.8	68.0	27	55.4	25.2
1996	209	783.7	413.3	53	154.0	88.1	28	58.9	31.6
1997	221	939.3	511.9	54	178.0	92.6	26	49.8	25.7

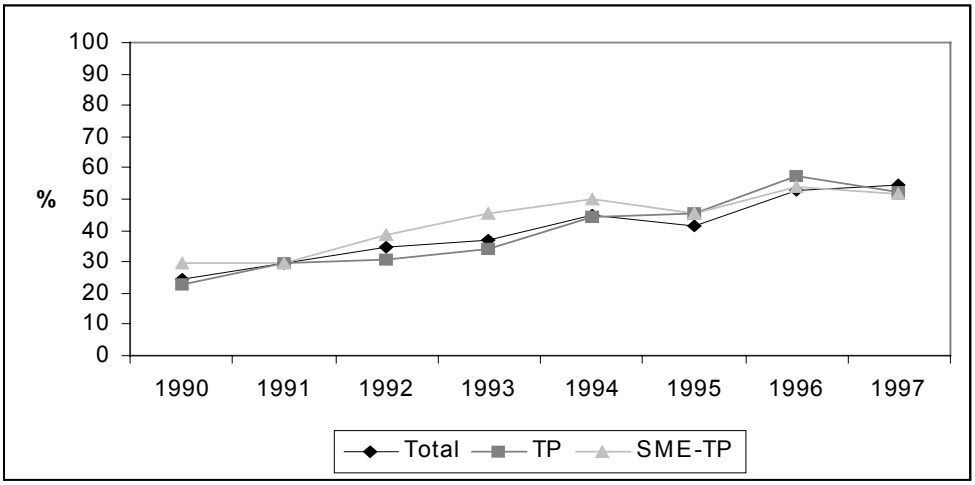
Source: ERP

The overall ERP support has increased significantly during the nineties. The number of projects increased by 14.5% 1997 compared to 1990 which is a 2% average increase per year. The provided loans rose by 87.6% 1997 compared to 1990 which is a 9.4% average increase per year. But the scale of the projects has decreased by 15.3%. Even more expansive are the two technology programmes. Especially the general technology programme has increased significantly: The number of projects shows a plus of 116% 1997 compared to 1990 (+11.6% average increase per year), the provided loans grew by 139% 1997 compared to 1990 (+13.3% average increase per year). The scale of the projects has also increased but only by 3.5% over the whole period since 1990. The growth rates of the SME-Technology programme are less high but still remarkable. The number of projects increased by 52.9% 1997 compared to 1990 (+6.3% average increase per year) and the loans by 127.6% 1997 compared to 1990 (+12.5% average increase per year). In this programme, also the scale of the projects has increased strongly by 29% 1997 compared to 1990 (+3.7% average increase per year).

Figure II.6 shows that the ratio 'loans per project volume' has increased continuously in the case of the ERP-funding in general as well as in the case of the two technology programmes in particular. The projects have been sudsidized to a larger and larger extent.

With regard to our study region, we see that the share of Upper Austrian projects is similar to the shares in FFF-projects (table II.15). Nevertheless, there is a difference. The share increased strongly until 1994 and has decreased since. Referring to loans, the share of Upper Austrian firms was slightly lower in most years than in the case of the FFF.

Figure II.6: Rates of project contribution of the ERP - in total and the two technology programmes



Source: ERP

Table II.15: Share of Upper Austrian firms in ERP-programmes

	Projects (%)	*Loans (%)*
1990	17.1	19.6
1991	16.8	20.5
1992	20.9	22.6
1993	19.9	17.5
1994	25.7	24.4
1995	22.5	17.1
1996	23.0	18.8
1997	17.2	18.1

For comparison: The share of Upper Austria in the national gross product of manufacturing was 22.4% in 1993.

Source: ERP

Interpreting the average ERP-loan per project or investment we cannot find any significant difference between Upper Austria and other parts of Austria (table II.16). But it is interesting that in 1997 the average loan per project was clearly higher than in all the years before, especially in Upper Austria. However, this does not apply two the two programmes we are interested in. The ERP-loans for technology-oriented projects are lower than in the other ERP-programmes and there seems to be no tendency to grow in the future.

Table II.16: Average ERP-loans per project

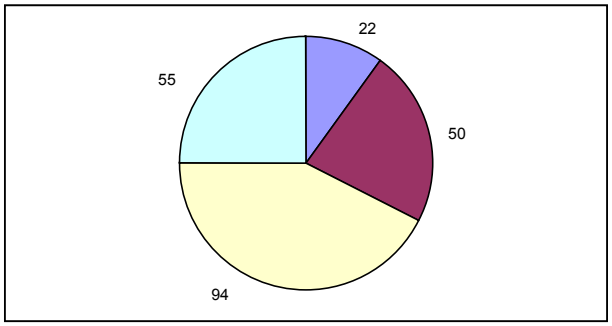
	E R P t o t a l		*Technology*	*SME-Technology*
	Austria	*Upper Austria*	*programme*	*programme*
	(1000 EURO)	*(1000 EURO)*	*(1000 EURO)*	*(1000 EURO)*
1990	1413.9	1620.8	1549.4	666.9
1991	1487.0	1812.2	2032.2	904.7
1992	1652.0	1790.8	2818.6	779.0
1993	2127.4	1878.1	2746.7	1678.5
1994	1877.9	1782.9	2693.3	1249.3
1995	2014.2	1524.6	1544.3	934.0
1996	1977.5	1618.5	1661.9	1129.0
1997	2316.0	2442.2	1714.5	992.2

Source: ERP

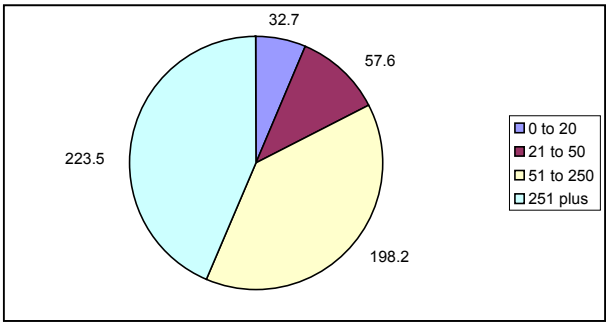
As we have seen in the case of the FFF-programme, most beneficiaries of the ERP-programmes are SMEs. Their share is even higher than in the case of the FFF (see figure II.7). In contrast to the similarities regarding firm size, the industrial structure is very different to the FFF (figure II.8). Metal products and the wood industry are the dominant sectors of the economy. Machinery, the main industry of FFF-participants, is still strongly represented, but its share in ERP-funds, especially with regard to loans, is far smaller. It has to be considered that this distribution is based on all ERP-participants (due to a lack of disaggregated data), the sectoral distribution of firms in the technology programmes might be different. But in general, these data mirror the fact that the ERP-support aims at "lower-tech" industries. Firms belonging to higher technological levels belong more to the clientele of the FFF.

Figure II.7: Distribution of the ERP-support differentiated by firm size in 1997

Projects



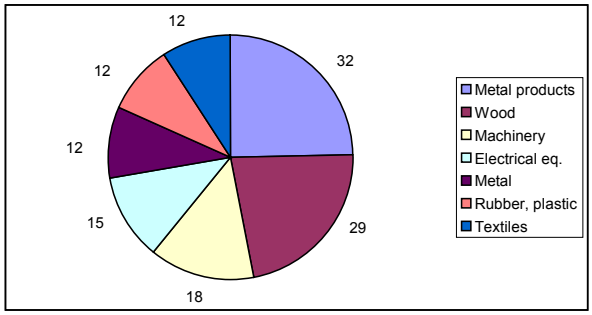
Loans (million EURO)



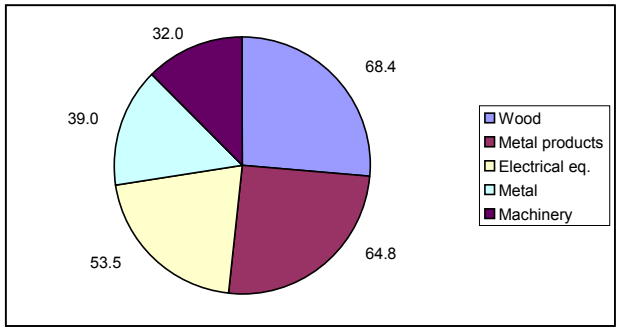
Source: ERP

Figure II.8: The most important ERP-supported industries in 1997

Based on projects



Based on loans (million EURO)



Source: ERP

The ERP considers the establishment of new jobs as an important criterion for the project evaluation. The following table shows the number of newly established jobs by ERP-supported projects and investments according to the information from ERP.

Table II.17: New jobs generated due to ERP-supported projects - in total and per project (in brackets)

	ERP - total	*Technology pr.*	*SME-Tech. pr.*	*Upper Austria - total*
1990	2492 (12.9)	679 (27.2)	89 (5.2)	200 (6.1)
1991	2905 (15.8)	854 (30.5)	263 (9.1)	337 (10.9)
1992	2283 (12.2)	369 (13.2)	283 (7.3)	486 (12.5)
1993	2319 (14.4)	1385 (28.3)	306 (9.9)	208 (6.5)
1994	1630 (9.3)	348 (10.5)	311 (7.4)	391 (8.7)
1995	3099 (15.2)	864 (19.6)	238 (8.8)	722 (15.7)
1996	2334 (11.2)	633 (11.9)	113 (4.0)	591 (12.3)
1997	3201 (14.5)	825 (15.3)	202 (7.8)	686 (18.1)

Source: ERP

More important than the absolute figures are the jobs per project. Due to the SME-restriction, it is not surprising that they are least in the SME-Technology programme. The Technology programme was in the early nineties clearly more successful in creating jobs per project than the other ERP-programmes. But since 1994 this difference has vanished, the technology programme leads to a similar number of jobs per project. In contrast to that, Upper Austrian ERP-beneficiaries increased the number of jobs per project in this time, clearly surpassing the ERP-total.

The ERP acts very much like an administrative authority. There is not too much concern about overall effects or deficits regarding the support activities, because legal instructions have to be applied without leaving much room for own initiatives. If there are evaluations, then they concern external programmes (e.g., RIP, see chapter 3.4 of part II), beyond the regular funding activity of the ERP.

With regard to future plans, there are some considerations that the ERP could engage in risk-financing. In the future the instruments used by the ERP could become more differentiated. One proposal is to reduce the time and standards of evaluation for small projects and to provide easily accessible capital (some kind of a surrogate for private capital) for a certain period of time. But this would be linked to the condition that the firm must find a cooperation partner, venture capital provider, private partner, or institutional investor in order to transform this capital into real equity capital. If the firm fails to find a partner, it will have to repay the amount as in the case of a normal ERP-loan.

3.3 Innovation and Technology Fund (ITF)

The "Innovations- und Technologiefonds" (ITF) was established in 1987. The financial resources of the ITF are rooted in the privatization of Austrian state owned energy supply companies during the eighties. The interest earned on these assets were used to fund the ITF. This construction leads to the problem of a procyclical effect of the ITF-support. The interest payments are linked to the official lombard rate. As a consequence the total amount of the ITF-grants changes in a way that it is lower in a crisis and higher in a boom period. The total amount which would be available by using the total interest earnings is massively reduced by the payments for the Austrian membership in the European Space Agency which requires nearly the half of this amount.

The ITF is administrated by the FFF and the ERP on behalf of the federal government. It is not an independent institution. It is a pool of funds with rules and targets how the funds have to be used, but the executive reponsibility is up to the FFF and the ERP (see the chapters 3.1 and 3.2 of part II). According to their focus areas, the FFF is responsible for projects of industrial applied research and development, whereas the transfer of innovations into regular production (so-called "research development and demonstration") is the task of the ERP. Projects are evaluated by these funds and proposed for support. The final decision which projects are to be supported are regularly taken by the "ITF-Ausschuß", consisting of representatives of the ministries of economic affairs and science, and other national authorities and interest groups. In order to speed up this procedure, the responsible ministers (the minster for economic affairs as far as the FFF is concerned and the minister of science in the case of the ERP) are allowed to decide directly on projects below a certain limit. The limits are 182,000 EURO (2.5 million ATS) in the case of the FFF and 363,000 EURO (5 million ATS) in the case of the ERP. The strategic decisions, i.e., which technological focus areas should be supported, are taken by the ITF-Kuratorium which consists of several Austrian ministers. This points to the most important difference of the ITF compared with the other two funds: it grants support only for certain technological areas.

In contrast to the FFF and the ERP, the ITF has a top-down approach. Using instruments like technology monitoring, cluster-analysis, and Delphi-surveys it tries to find those areas with the highest potential for technological development and economic growth where, at the same time, Austrian firms are seriously lagging behind. This process is not highly formalized. It is very difficult to find the right balance between a narrow or wide definition of the targeted technology field and the range of potential applications. To find viable compromises in this respect is difficult and the relevant conditions often change quite rapidly. This is one of the reasons why formalized

procedures to define target areas are difficult to implement. No target area (sub-programme) has a time period of more than five years. The definition of new target areas occurs from time to time more or less on an ad-hoc basis reacting on new major developments or the end of a programme. It is mostly done in the way of expert discussions in the "ITF-Kuratorium".

Nevertheless, the importance of precisely defined goals for each focus area has been recognized. If such goals are missing, the probability to receive inadequate or even no project proposals at all is very high, because the firms lack sufficient orientation. In the early years of the ITF the most important criteria for the definition of focus areas were technological. More recently this seems to change in favour of economic applicability. But the technical perspective still remains very important.

Table II.18: Support method/instruments of the Innovation and Technology Fund

	ITF
Financial instruments:	Non-repayable grants
Applicable projects/costs:	Internal and external costs of research and development for a marketable product or process, costs for commercialization and technology application. This comprises immaterial (e.g., personnel, consulting, software, training, design) and material investments (e.g., research or testing equipment).
Maximum contribution:	The upper limit of the cash value of the grant differs: * Projects of industrial basic research: 50% * Projects of applied R&D: 25% * Projects of technology transfer: 50% * Feasibility evaluations: 25% in general, 50% for SMEs For SMEs all limits can be plus 10%; for areas of regional support all limits can be plus 5%.
Requirements for applicant:	* Company with operating location or research department in Austria * Research organizations with location in Austria, if they perform contributions to industrial R&D in Austria * Austrian technology transfer institutions
Necessary firm features:	R&D activities must belong to one of the ITF-focus-areas

Source: ITF

The only instrument of the ITF to support innovative projects is the provision of grants. Actual conditions differ slightly according to certain focus areas. But the variations are small. The regular maximum grant for one project is 1.8 million EURO (25 million ATS). Larger grants are possible, but have to be decided by the "Kuratorium". But, this has happened only once so far.

The ITF excludes projects which belong to the revitalization and the establishment of new firms (there is a special programme for seed-financing, see below). It only supports innovative projects of existing and successful companies. Innovation projects must have a sufficiently high growth potential, they must not be simple adoptions, commercial effects must be clearly assessable. The ITF does dot support inventions, but only commercializable innovations. Projects have to be adequate to the size of the applying firm. The same technological concept could be supportable in the case of a SME, but not in the case of a large company. In this context it has to be mentioned that

the application of a technological concept matters, not the technology per se. For example, Internet-technology for Intranet-applications within a big company would never be supported, the same technology for a network between SMEs for cooperative business applications could be worth funding.

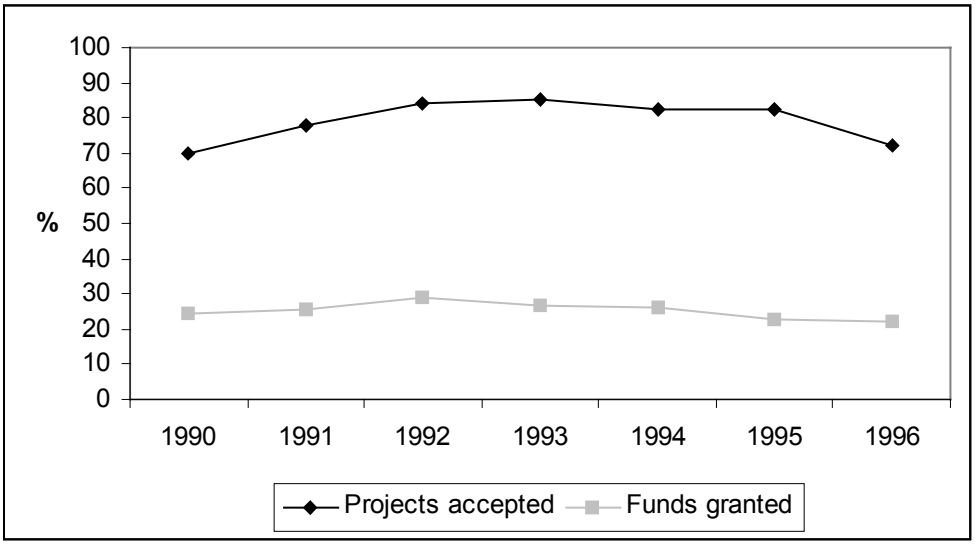
Table II.19: General support statistics of the ITF

	Projects applied	*Projects accepted*	*Project volume (million EURO)*	*Funds granted (million EURO)*
1990	133	93	128.3	31.5
1991	131	102	86.5	22.2
1992	166	140	87.9	25.2
1993	222	189	109.1	28.9
1994	303	249	148.5	38.5
1995	244	201	111.6	25.1
1996	213	154	65.7	14.6

Source: ITF

The table shows that the acceptance of projects and the amount of funds granted to them has decreased significantly. This is primarily due to the fact that the ITF shall be replaced by a new support programme. The existing focus areas are going to expire soon. This explains why the funds and the scale of all projects in 1996 were even less than in 1990 (-53.5% in the case of the granted funds, -48.8% in the case of the total project scale). The numbers of applications and accepted projects are still higher than in 1990 (+ 60.2% regarding applications, +65.6% regarding accepted projects), but compared to the maximum in 1994 the number has also fallen sharply (70% in terms of applied, 62% in terms of accepted projects).

Figure II.9: Rates of project acceptance and project contribution of the ITF



Source: ITF

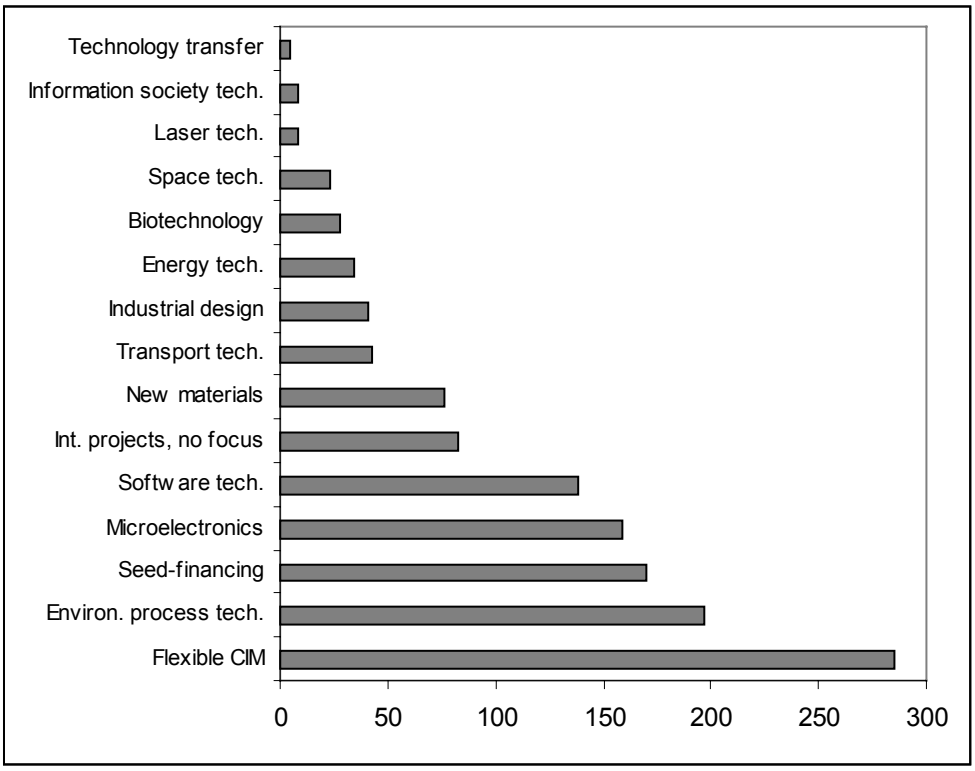
As already mentioned, besides the regular funding programme of the ITF, there is a special activity called "Seed-Financing" which is administrated by the Austrian Innovation Agency ("Innovationsagentur"), but funded by the ITF. The seed-financing programme supports start-ups in new fields of technology, if they have a sufficiently high technological level applying extraordinary product-, service-, or process-know-how. To be accepted as a start-up, it is not necessary that the firm has been founded recently. It can be up to two years old, if there were no significant business activities in this period. The support of start-ups which fulfill these requirements is divided into two phases. The first one - the conception phase - supports consulting and feasibility studies by grants up to 14,500 EURO (200,000 ATS); the second one - the implementation phase - supports the foundation and building up of the firm (personnel and operating costs, commercialization, consulting, etc.) by special loans (interest rates and redemption depending on profits, no guarantees required) up to 436,000 EURO (6 million ATS).

The largest part of the ITF-funds is administrated by the ERP. In 1996 the ERP was responsible for 42%, the FFF for 34% of the funds. The rest accounts for the special seed-financing programme. The distribution of the share of projects administrated by the ERP and the FFF has varied significantly in the nineties. The ERP has always been responsible for the majority of the funds. But especially in the last three years, the FFF has increased its part of the ITF-budget (from 28% in 1994 to 35% in 1996). In addition, the separate seed-financing programme has increased its share of the ITF-funds from 9% in 1990 to 23% in 1996.

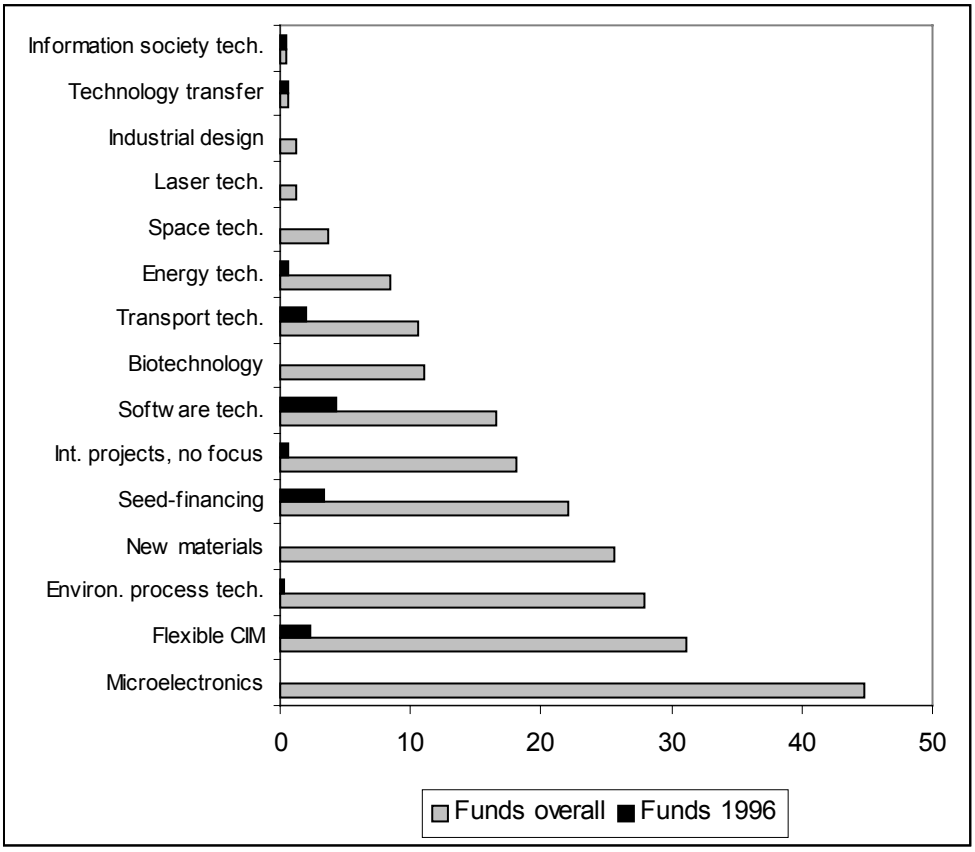
Figure II.10 presents an overview of the focus areas of the ITF and the total amounts of funds which have been attributed to them until 1996. The overall funds show the size of each focus area for the whole period of existence since 1987. The funds in 1996 show which focus areas are currently the most important ones and which areas are already finished. Interpreting these data we find that there are a few areas dominated by large-scale projects, especially microelectronics and new materials. These areas rank clearly higher in terms of funds than in terms of projects. More balanced is the situation in the case of flexible CIM which ranks second in terms of funds and which is top in terms of projects. In fact, this one was probably the most successful of all focus areas.

Figure II.10: Technological focus areas of the ITF

a) Overall projects (1987 - 1996)



b) Overall funds (1987 - 1996) and funds 1996 (million EURO)



CIM = Computer integrated manufacturing

Source: ITF

The percentage of Upper Austrian firms participating in the ITF-programme has been fluctuating around the usual 20%-share of Upper Austria in all funding programmes analyzed in this report.

Table II.20: Share of Upper Austrian firms in R&D-projects and -funds provided by the ITF

	Projects (%)	*Funds (%)*
1990	16.1	23.1
1991	13.9	17.5
1992	21.1	20.3
1993	25.6	30.2
1994	19.3	22.6
1995	20.8	19.8
1996	12.8	28.4

For comparison: The share of Upper Austria in the national gross product of manufacturing was 22.4% in 1993.
Source: ITF

The grants per project provided by the ITF have decreased continuously since 1990 which is primarily due to the expiring of most programmes (table II.21). Upper Austria is a special case, because of the sharp increase in 1996, obviously due to a few major projects. But the long-run trend is the same.

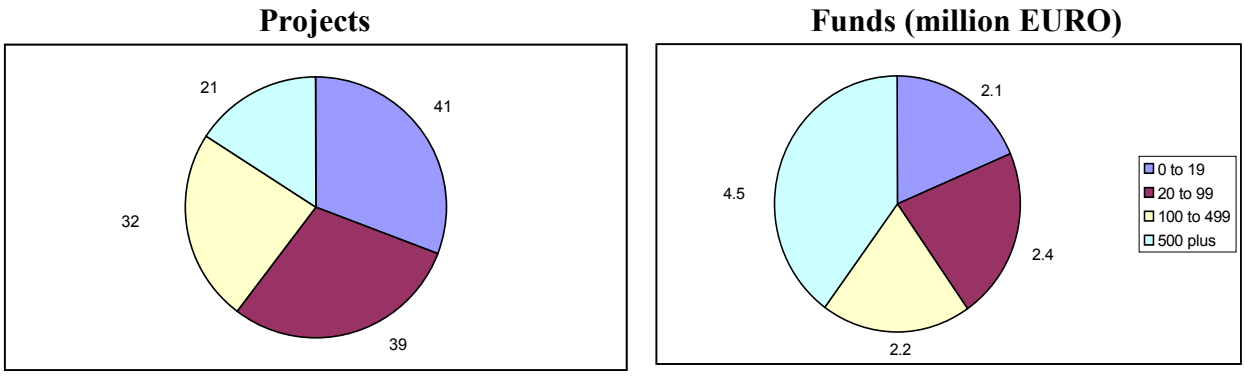
Table II.21: Average ITF-grants per project

	Austria (1000 EURO)	*Upper Austria (1000 EURO)*
1990	339.2	436.0
1991	217.3	297.3
1992	180.7	190.7
1993	153.1	183.4
1994	154.4	191.0
1995	125.1	118.3
1996	95.3	188.1

Source: ITF

Regarding the size of firms receiving ITF-grants there is a strong concentration of funds on large companies. As the following figures show, 16% of the projects are conducted by firms with 500 or more employees. But these firms account for 40% of the funds. This mirrors the fact that high-tech-R&D is concentrated in large firms in Austria.

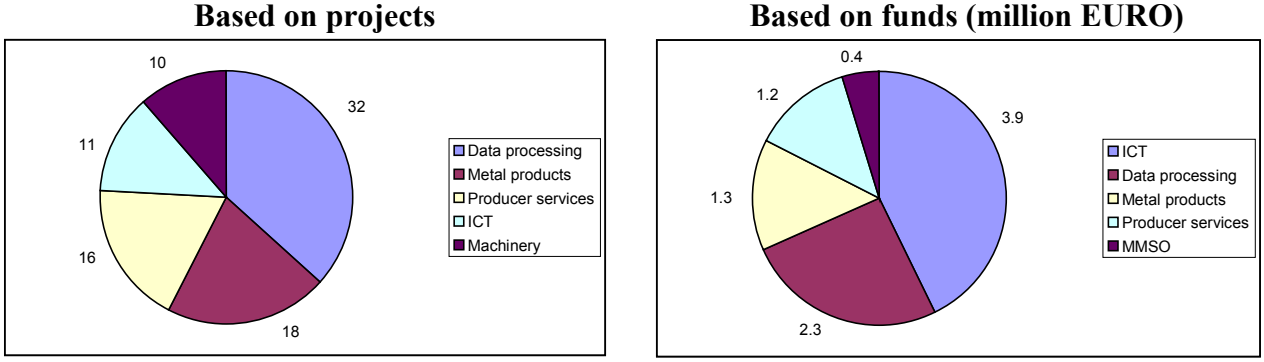
Figure II.11: Distribution of the ITF-support differentiated by firm size in 1996



Source: ITF

The industries which are most frequently benefiting from ITF-grants show again a "high-tech"-bias. Especially, if we look at the distribution of funds, we find that data processing and information and communication technologies are predominant. Of course, it has to be considered that the focus areas (see figure II.10) lead necessarily to a strongly biased structure. What is more interesting is the remarkable share of producer services. This sector can benefit clearly more from ITF-funds than from other support programmes.

Figure II.12: The most important ITF-supported industries in 1996



Source: ITF

All focus areas of the ITF have been evaluated by external experts. One can find significant differences in the success of these programmes. The most successful has been the the focus area on flexible computer integrated manufacturing. An example for a little successful programme is laser technology. In this case the major problem was that only very few Austrian firms were actively developing in the field of laser technology. More often they were simply engaged in the adoption of laser applications. The technology is widely used but rarely developed in Austria.

The major problem of the ITF is its mission-orientation since it has too little funds available to grant significant support for each of its focus areas. Another problem in this context is that sometimes there were not enough qualified and interested firms.

It is intended to dissolve the ITF at the end of 1998. Its activities shall become a part of a new major institution in the Austrian technology policy, the so-called "KIR" which stands for "competence centres", "impulse programmes" and "government initiatives". The role of the ITF will be taken over by the impulse programmes. Basically, they will be organized very similar to the ITF and they will follow the same top-down support strategy and similar goals.

3.4 Effects of the joint regional/national innovation support programme 'Regional Innovation Premium' (RIP) in Upper Austria

The "Regionale Innovationsprämie" (RIP) was introduced in 1990. Originally, it was only a short-term initiative for three years. But due to its success, the programme was renewed until 1995. It is now in its third extension and will be valid until 1999. The political intentions of this programme are to support the economic recovery of old industrial regions and to contribute to structural improvements and economic growth of peripheral regions (Hutschenreiter, 1997).

The RIP shall support existing firms as well as start-ups and the establishment of "qualified" plants, i.e., plants with higher value-added production than simple assembly. The goals of the RIP are therefore

- as far as old industrial regions are concerned, support for innovation and structural improvements,
- in the case of peripheral regions, additionally, "qualified" capacity enlargements

The RIP is administrated by the ERP which is also responsible for the assessment of the project applications. The final decision is prepared by a commission consisting of representatives of the state of Austria and the provinces and taken by the minister of science and transport together with the respective representative of the province (Hutschenreiter, 1997).

The RIP is a joint national/provincial programme. At present, seven of the nine Austrian provinces are participating in this programme. It is equally funded by federal and provincial budgets and, additionally, by EU-structural funds. Before Austria could apply for EU-structural funds, the federal and provincial share of any grant was 50% each. Now the EU funds have become very important, even if restricted by certain limits for the EU co-funding. The Austrian part is still equally shared by the federal and provincial government.

The RIP is a non-repayable grant for an investment project consisting of two components:

- the investment premium for the innovation or technical improvement and
- the job premium for the creation of new jobs

The investment premium can account for up to 10% of the supportable costs. In the case of an extraordinary contribution to structural improvements in the region the limit increases up to 20%.
The second component - the job premium up to 10% of the supportable costs with an upper limit of 3,600 EURO (50,000 ATS) per job - can be granted, if the project creates jobs which contribute significantly to the "quantitative and qualitative improvement of the regional labour market".

There are several upper limits of support for a single project:

- Investment premium: 727,000 EURO (10 million ATS)
- Job premium: 363,000 EURO (5 million ATS)

Table II.22: Support method/instruments of the Regional Innovation Premium

	RIP
Financial instruments:	Non-repayable grants
Applicable projects/costs:	* Investments in machinery, hardware, and software * Construction (building etc.) * Immaterial and planning costs
Maximum contribution:	Total premium: * Investment premium: 10% of the supportable project costs (in the case of an extraordinary structural improvement 20%); 727,000 EURO (10 million ATS) * Job premium: 10% of the supportable project costs; 3,600 EURO per job; 363,000 EURO (5 million ATS) in total
Necessary firm features:	Location in support areas. In Upper Austria these areas are "Mühlviertel", "Innviertel", and "Steyr-Kirchdorf" (see below)

Source: ERP

Support can be granted for

- new investments
- construction costs
- immaterial costs (e.g. consultancy, external training)

Direct applications of companies are possible. Nevertheless, in most cases the contacts are mediated by the economic departments of the provincial governments and, in fewer cases, by banks.

The RIP is an instrument to support innovative investments in general. The size of the firm is no relevant criterion. There is also no sectoral focus. Further, the RIP does not exclusively focus on innovation. It is an investment support programme with a strong innovation component. Job creation is a major goal of this programme (Hutschenreiter, 1997).

The following type of firms are allowed to apply for the premium:

- Manufacturing firms in international competition and suppliers to such firms
- Innovation oriented producer service firms
- Individuals or organizations which are going to establish a firm corresponding to the criteria above

Further, applicants which are profitable, rapidly growing and which have "marked entrepreneurial functions" (i.e., effective marketing, distribution, R&D) are preferred. Looking at all these criteria, it seems that a deficit of the RIP is the insufficient operationalization of the goals and criteria which weakens the selectivity of this programme. Many criteria are simply too general to make an important difference betwen firms (Hutschenreiter, 1997).

The RIP does not aim at specific industries or size-classes. But there is another central criterion for differentiation - the region. There are exactly defined target areas. Only within these areas support is possible. Areas in Upper Austria which are allowed to receive RIP-funds are (see also figure I.6):

- Mühlviertel: Freistadt, Perg, Rohrbach, Urfahr-Umgebung
- Innviertel: Braunau am Inn, Grieskirchen, Ried im Innkreis, Schärding
- Steyr-Kirchdorf: Steyr, Kirchdorf an der Krems, Steyr-Land

Projects can be supported, if they represent a completely defined investment project with one of the following goals (Hutschenreiter, 1997):

- Establishment of a plant/start-up
- Product or process innovation
- Significant capacity enlargement leading to a basic improvement of the production structure
- Producer services which are in serious short supply in the region

The amount of the grant is dependent on the impulses on the regional economy, comprising

- relations to regional suppliers (products as well as services) and
- training activities which improve the qualification level in regional employment

In the case of new establishments/start-ups there are some additional aspects which influence the effects on the regional economy:

- Value added per employee
- Qualification level of employees
- Level of salaries
- Stage within the production chain

Consequences for employment through the projects are very important criteria for RIP-support. One of the conditions to receive a RIP-grant is that the number of employees has to be maintained for at least 3 years from the time of application. New and high-quality-level jobs are important arguments for the amount of support. Finally, organizational improvements also play an important role in the assessment of applications (Hutschenreiter, 1997).

The RIP is a relatively new instrument. In the first year it started only with very limited funds (see table II.23). Therefore it is reasonable to take 1991 as the base year for the calculation of growth rates. But even in this case, the growth is remarkable; the number of projects increased by 35.7% comparing 1997 to 1991 which is an average increase per year of 5.2%. The total volume of the projects grew by 43.3% in this period of time (+6.2% average increase per year). Finally, the provided grants increased by 50% (+7% average increase per year). The contribution of the RIP to the innovation projects has been rather stable. In most years the grants have covered around 10% of the total volume of all projects supported. In 1997 this ratio was 10.7%.

Table II.23: General support statistics of the RIP

	Projects	*Project scale (million EURO)*	*Grants (million EURO)*
1990	17	14.6	1.6
1991	70	170.7	17.5
1992	70	148.0	15.1
1993	47	153.6	14.6
1994	62	144.5	15.4
1995	90	327.1	25.1
1996	88	235.0	23.7
1997 *	95	244.5	26.2

* Includes a second programme - RIF. This programme has started only recently and the amounts are still negligible.

Source: ERP

Tthe next table shows to what extent the additional (contingent) job premium was granted:

Table II.24: The job premium 1993 - 1996, total and differentiated by size

	Funds (1000 EURO)	*Share of each size-class in the total job premium (%)*	*Share of the job premium in the total RIP (%)*
Total	5857		9.3
1 to 19	886	15.1	17.0
20 to 49	1374	23.5	13.7
50 to 99	956	16.3	12.1
100 to 499	2338	39.9	7.6
500 plus	302	5.1	4.4

Source: ERP, Hutschenreiter (1997)

It can be seen that the share of the job premium in the total RIP-support is rather low (third column of table II.24). This means that the criteria of the project quality necessary to receive this additional support are only rarely met. For the purpose of this research project, though, it is very interesting that the SMEs (in this case up to 99) received a significantly higher share of this additional support. Further, Upper Austrian firms are more successful than firms from other parts of Austria in receiving the job premium. They received 1 million EURO in the period from 1993 to 1996 (17.2% of the total RIP). On average, the job premium for Upper Austrian companies accounted for 13.3% of the whole premium which is clearly higher than the overall share of 9.3%.

Referring to the share of Upper Austrian firms in RIP-funds the next table shows that the variation is even stronger than in the case of the ITF (see chapter 2.3):

Table II.25: Share of Upper Austrian firms in innovation projects supported by the RIP

	Projects (%)	*Grants (%)*
1990	0.0	0.0
1991	12.9	23.3
1992	15.7	13.0
1993	10.6	4.5
1994	17.7	17.5
1995	14.4	21.4
1996	34.1	34.9
1997	16.8	6.7

For comparison: The share of Upper Austria in the national gross product of manufacturing was 22.4% in 1993.
Source: ERP

The average grants per project had fluctuated extremely at the beginning of the programme, but since 1994 has remained rather stable. As far as Upper Austrian companies are concerned, the fluctuations remained very strong over the whole period (table II.26).

Table II.26: Average RIP-grants per project

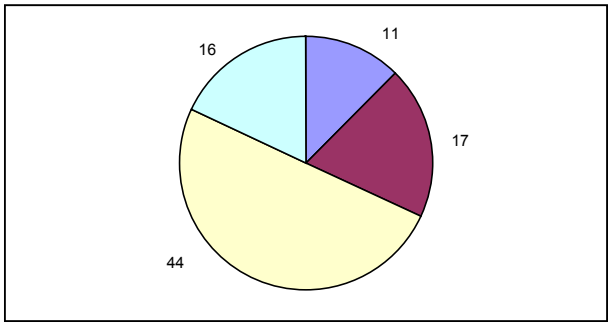
	Austria (1000 EURO)	*Upper Austria (1000 EURO)*
1990	94.0	-
1991	249.1	452.2
1992	215.9	178.3
1993	310.8	130.8
1994	248.5	244.5
1995	279.4	413.7
1996	270.0	276.2
1997	275.4	109.1

Source: ERP

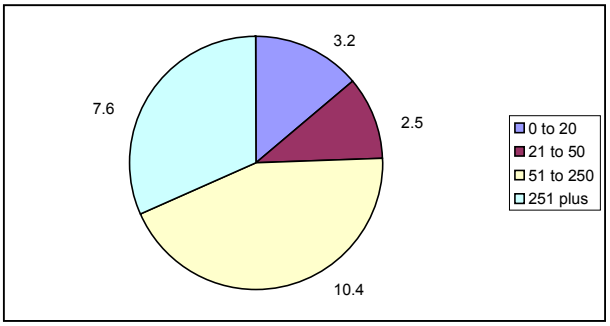
The share of SMEs is extremely high, especially in terms of projects (see figure II.13). It is even higher than in the case of the ERP-programmes. Looking at the data, we find a clear SME-focus of the RIP-programme.

Figure II.13: Distribution of the RIP-support differentiated by firm size in 1996

Projects



Grants (million EURO)

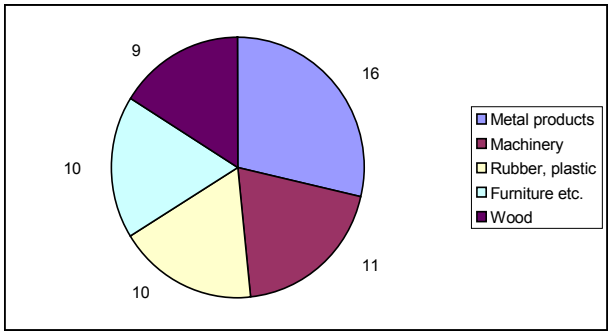


Source: ERP

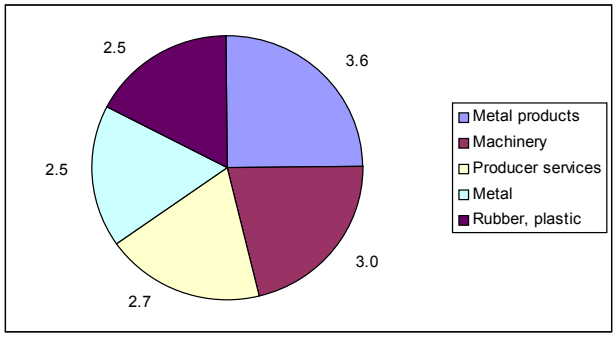
The sectoral structure of the RIP-firms is very similar to the structure of beneficiaries of the regular ERP-programmes. The only significant difference is machinery which has a higher share with regard to the number of RIP-projects and the amount of RIP-funds than in the case of the ERP-programmes.

Figure II.14: The most important RIP-supported industries in 1996

Based on projects



Based on grants (million EURO)



Source: ERP

In Upper Austria the most important RIP-beneficiaries belong to timber products, metal products, machinery and chemicals. Only little support is directed towards producer services.

The effectiveness of the RIP is assessed in several ways. The ERP publishes data on newly created jobs (see table II.27). In general, the jobs per project on average are relatively similar to the SME-Technology programme of the ERP. The numbers for Upper Austria vary too much for a general interpretation. This is partly due to the small number of projects which has the consequence that specific cases can have a huge effect on the aggregate numbers. For example, in 1997 there were only 16 projects in Upper Austria.

Table II.27: New jobs generated due to RIP-supported projects - in total and per project (in brackets)

	Total	*Upper Austria*
1990	114 (6.7)	0 (-)
1991	601 (8.6)	208 (23.1)
1992	808 (11.5)	42 (3.8)
1993	504 (10.7)	51 (10.2)
1994	606 (9.8)	76 (6.9)
1995	893 (9.9)	363 (27.9)
1996	1165 (13.2)	305 (10.2)
1997	676 (7.1)	41 (2.6)

Source: ERP

The RIP has been evaluated recently (Hutschenreiter, 1997). A summary of the most interesting results of this study will be presented in the following:

In the beginning, the share of RIP-supported start-ups versus capacity enlargements was clearly higher than in the more recent past (table II.28). Capacity enlargements are becoming more and more important instead. Between 1990 and 1992 start-ups accounted for 21% of projects and grants and 42% of newly created jobs (Hutschenreiter, 1997). But the table shows that these shares have significantly decreased afterwards. Start-ups are losing importance, capacity enlargements are becoming more and more predominant as RIP-beneficiaries.

Table II.28: RIP-supported capacity enlargements versus start-ups 1993 - 1996

	Projects	*Grants (million EURO)*	*New jobs*
Capacity enlargements:			
Total	221	54.2	1677
(share in total RIP)	89.5%	86.3%	72.5%
Upper Austria	36	7.1	322
(share in total RIP)	90.0%	92.7%	80.3%
Start-ups:			
Total	26	8.6	636
(share in total RIP)	10.5%	13.7%	27.5%
Upper Austria	4	0.6	79
(share in total RIP)	10.0%	7.3%	19.7%

Source: ERP, Hutschenreiter (1997)

To assess the performance of RIP-firms in comparison with the whole manufacturing sector in Austria, the author used several indicators, one of them is ‘changes in turnover’ (see table II.29).

Table II.29: Change in turnover of RIP-supported firms compared with the industrial average

	RIP-firms	*Total manufacturing*
1992 / 1990:		
All firms	+ 7.8	+ 1.1
Paper	+ 38.1	- 0.4
Timber	+ 22.2	+ 7.3
Minerals	+ 32.0	+ 3.0
Chemicals	+ 4.3	- 0.5
Textiles	+ 0.5	- 2.2
Machinery	+ 0.9	+ 10.8
Metal products	+ 17.2	+ 3.1
Electro, electronics	+ 15.0	- 0.7
1994 / 1992:		
All firms	+ 9.8	+ 3.6
Paper	+ 3.4	+ 5.0
Non-ferrous metals	+ 6.7	+ 34.6
Timber	+ 5.6	+ 0.3
Minerals	+ 35.8	+ 1.7
Chemicals	+ 14.6	- 0.5
Food	+ 0.3	+ 23.6
Textiles	+ 45.3	- 9.8
Machinery	+ 8.2	- 0.4
Metal products	+ 0.7	+ 1.1
Electro, electronics	+ 14.8	+ 7.1
Transport, vehicles	+ 15.3	+ 2.9

Source: ERP, Hutschenreiter (1997)

With regard to changes in turnover, the data are unambiguous: RIP-supported firms clearly outperform other companies. This applies not only to the total, but also to almost all industries. Nevertheless, there are some remarkable exceptions. In the first period (from 1990 to 1992) the RIP-firms belonging to machinery were less successful than other companies of this industry in Austria. In the second period this applies to non-ferrous metals, metal products and food.

Hutschenreiter comes to the following conclusions concerning the RIP (1997):
1) Producer services are not sufficiently represented.
2) The RIP targets primarily SMEs. The support for large firms is of very low intensity in terms of the share of the grant in the total project volume. Further, large firms create rather few new jobs. Therefore, it might be reasonable to restrict the RIP definitely to SMEs.
3) According to the goals, most RIP-grants are used in peripheral regions (69%).
4) Start-ups lose importance compared with capacity enlargements.
5) RIP-firms have a higher growth of turnover than other companies. Additionally, the growth is less dependent on the general economic activity.

The author makes the following proposals to improve deficits of the RIP (Hutschenreiter, 1997):
1) The assessment procedure should be applied more strictly.
2) Higher standards regarding the innovativeness of projects should be required from the firms.
3) Producer services should become a specific target-sector for the RIP.
4) The share of grants applicable for the use of external services should be increased.
5) More focus on start-ups.
6) The institution which decides on the support for projects should become more independent.

3.5 Comparison of the direct support instruments

At the end of our analysis of the innovation support programmes, the key data of the national funds and the Regional Innovation Premium are presented in one table (II.30), so that they can be easily compared. The main findings are:

The programme which focusses most on SMEs is the RIP. But also the ERP in general has a large share of SMEs. Smaller firms are least represented in the case of the ITF. Typical "high-tech" industries are especially important in the cases of FFF and ITF which are the programmes with an explicit R&D-orientation. THE ERP in general and the RIP are more relevant for "lower-tech" industries.

The financially strongest institution is the ERP. Nevertheless, it has to be considered that this institution offers a wide range of support. If we look at the technology-oriented programmes of the ERP only, the granted funds of the FFF are similarly large. On the contrary, the ITF and the RIP are far smaller programmes.

Funds per project are highest in the case of ERP-programmes. This is mainly due to the type of support, however. The ERP offers loans; programmes offering (partly or exclusively) grants have, of course, a lower ratio of funds per project.

Upper Austrian companies account for around 20% of the total funds in all programmes. Further, there are hardly significant differences to overall Austria regarding the average funds per project.

If these figures are compared with the regional funds for R&D and innovation, the dominance of the national instruments become clear. The FFF provided 31.9 million EURO (grants and loans) in 1997 to firms in Upper Austria. Total ERP-loans to Upper Austrian firms were 92.8 million EURO. Unfortunately, there are no regional data for single ERP-programmes available. But it can be assumed that the share of the two technology programmes on the national scale (23%) is similar to their shares in the regions, so the ERP-technology support for Upper Austrian firms in 1997 would be approximately 21.3 million EURO. ITF-projects of regional firms accounted for 3.2 million EURO (1996). The total RIP-funds for Upper Austria were 1.7 million EURO, equally shared between the state of Austria and the province of Upper Austria. This sums up to 58.1 million EURO. This amount has to be compared with the provincial budget of 17.1 million EURO which was available in 1997 for any kind of R&D in Upper Austria (see table II.5).

Table II.30: Comparison of the support activities of the national funds and the RIP

	FFF	ERP-total	ERP-Tech. pr.	ERP-SME-Tech. pr.	ITF	RIP
Provider:	National	National	National	National	National	National/ Province
Support method:	Grants/ Loans	Loans	Loans	Loans	Grants	Grants
Targeted innovation stage / function:	Applied R&D	See special programmes to the right	Commercialization	Commercialization	Applied R&D and Commercialization	Innovation and Capacity enlargement
Share of SMEs in % for all of Austria (recent data):*						
Based on						
projects:	72.60	75.11	-	-	60.15 (84.21)	81.82
funds:	50.00	56.35	-	-	40.18 (59.82)	68.09
Empl. classes:	< 250	≤ 250			< 100 (< 500)	≤ 250
Most important industries for all of Austria (recent data):*						
Based on						
funds:	Machinery	Wood	-	-	ICT	Metal prod.
	ICT	Metal prod.	-	-	Data proc.	Machinery
	Chemicals	Electr. eq.	-	-	Metal prod.	Prod. services
**Latest year:*	1997	1997			1996	1996
*Average funds per year since 1990**:*						
Austria: (mill. EURO)	110.9	357.9	80.8	31.9	26.6	17.4
Upper Austria: (mill. EURO)	23.9	70.1	-	-	5.5	3.5
Share in %	21.59	19.58	-	-	20.41	20.34
(Share of Upper Austria in national gross product of manufacturing in 1993: 22.4%)						
*Funds per project since 1990**:*						
Austria: (1000 EURO)	173.5	1866.1	2059.4	1067.2	165.1	258.3
Upper Austria: (1000 EURO)	168.9	1796.3	-	-	201.1	260.8
***Period:*	A: 1990-1997 UA: 1991-1997	1990-1997	1990-1997	1990-1997	1990-1996	A: 1990-1997 UA: 1991-1997

Sources: FFF, ERP, ITF

III

INNOVATION IN UPPER AUSTRIA'S SME-SECTOR AND THE EFFECTS OF SUPPORT INSTRUMENTS

In part III we are going to deal with the innovation activities of Upper Austria firms, especially focussing on SMEs. We will investigate their external relations in the innovation process, the problems they are confronted with, and the use and effects of innovation support instruments. The main source of the analysis in this part is the survey on innovation in selected SME-sectors. For parts of this analysis it was possible to use additional materials and data sources.

1 The company survey on innovation - general information about the sample

Technical information about the company survey on innovation was already presented in chapter 3 of part I. The next table shows the samples of addressed firms, the number of respondents, and the response rate.

Table III.1: The survey sample

	Samples, response
Total number of addressed firms:	
Provided by FFF, ERP, technology centres	420
Provided by Wirtschaftskammer Oberösterreich	708
Total number	1128
Number of respondents:	
Test sample	131
Control sample	73
Total sample	204
Response rate:	18.1%

The "test sample" comprises all respondents participating in the selected programmes FFF, ERP-Technology programme, ERP-SME-Technology programme, ITF, RIP, and firms which are located in Upper Austrian technology centres or use their services. All other firms belong to the "control sample".

In the following analysis we will, first, compare the main results between firms belonging to the SME-test sample, the SME-control sample, and all firms which are not SMEs. Then, we will investigate the effects of the selected support instruments on the innovation activities of the SMEs (i.e., the SME-test sample only).

1.1 The structure of the survey sample and its representativeness

In the following, the structure of the sample and the features of the responding firms will be briefly described. The shares of SMEs and firms supported by the investigated instruments is summarized in table III.2. In general, the response was satisfactory. Especially many firms of the group based on the addresses of FFF, ERP, and the technology centres were willing to cooperate in the survey (resulting in a specific response rate of 31%). Of course, at the very detailed level of SMEs per support instrument the number of respondents is in some cases small.

Table III.2: Sample structure - SME-status and participation in selected support programmes

Absolute numbers (in % of total number of respondents)	*SME*	*Large or dependent firm*	*Total*
Test sample	78 (38.2%)	53 (26.0%)	131 (64.2%)
Control sample	62 (30.4%)	11 (5.4%)	73 (35.8%)
Total	140 (68.6%)	64 (31.4%)	204 (100.0%)

Source: SMEPOL-survey

Overall, the structure of the Upper Austrian economy is well represented by the sample (see table III.3). Based on the number of employees, only three industries are less represented in the sample than in the real industrial structure - glass and ceramics, chemicals, and textiles and clothes. On the other hand, only one sector - metal and metal products - is strongly overrepresented.

Considering the distribution of firms according to the number of employees, there is a slight bias in favour of larger firms. It is a frequent problem of surveys that larger companies are, generally, more willing to cooperate than SMEs.

Table III.3: Representativeness of the sample (share of industries and size classes in %)

	Sample (%)	*Upper Austria (%)*
Industries (share in employment):		
Glass, ceramics	1.0	6.4
Chemicals	3.8	13.7
Paper (products)	3.5	3.7
Wood products	6.9	7.1
Food	5.4	5.6
Textiles, clothes	1.5	6.0
Metal (products)	39.4	20.1
Machinery	23.3	21.8
Transport (vehicles)	8.3	9.3
Electrical eq., electronics	7.0	6.3
Employment size (share in firms):		
1 - 99	66.8	72.7
100 - 199	8.3	12.8
200 - 499	18.1	10.5
500 - 999	3.6	2.5
≥ 1000	3.1	1.5

Data for Upper Austria based on manufacturing sector.

Source: Lackinger, ÖSTAT, SMEPOL-survey

1.2 Basic characteristics and features of the firms

Regarding the size of companies in terms of number of employees and turnover per year the structure of the three subsets of our sample is presented in table III.4.

The share of very small firms with less than 10 employees is larger in the case of the SMEs of the control-sample than those of the test-sample. In the case of the firms which are not SMEs, most of them have more than 250 employees. But there is also a considerable number of small firms (40%) which are not sufficiently independent to be classified as SMEs.

Regarding the development within the last three years, most test-SMEs and large/dependent firms have increasing sales and employment. The control-SMEs have developed significantly worse, both in terms of turnover and employment. In general, stagnation or decline is more frequent in the case of employment than in the case of sales. Of course, turnover figures are in nominal terms which explains a part of this difference. Another explanation is an increase in labour productivity.

Table III.4: Size distribution of firms (share in %)

	SME-test	*SME-control*	*No SME*
Employees:			
1 - 9	38.7	43.3	4.8
10 - 49	30.7	28.3	11.1
50 - 249	30.7	28.3	23.8
250 - 499			34.9
500 - 999			11.1
≥ 1000			14.3
Tendency:			
Increasing	63.6	28.8	67.7
Constant	31.2	54.2	22.6
Decreasing	5.2	16.9	9.7
Turnover (million EURO):			
< 5	69.0	72.7	14.8
< 10	11.3	12.7	6.6
< 20	9.9	5.5	9.8
< 40	9.9	7.3	18.0
< 80	0.0	1.8	24.6
< 160	0.0	0.0	9.8
< 320	0.0	0.0	4.9
≥ 320	0.0	0.0	11.5
Tendency:			
Increasing	81.6	57.9	85.5
Constant	11.8	31.6	11.3
Decreasing	6.6	10.5	3.2

Source: SMEPOL-survey

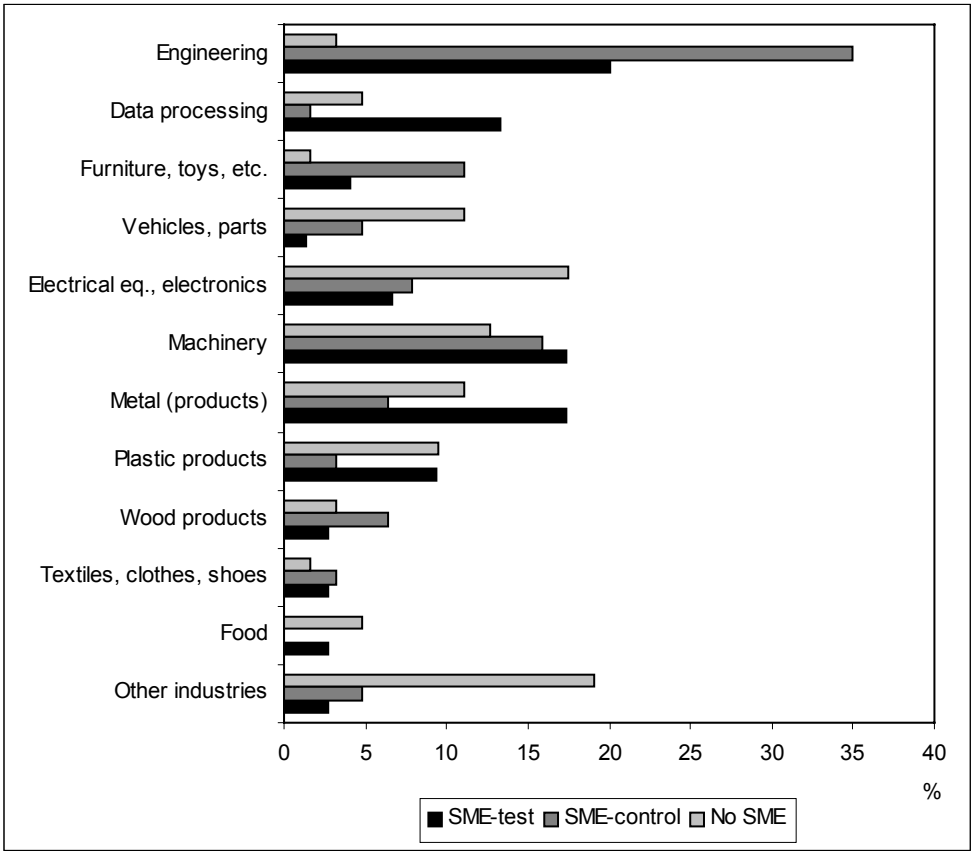
Concerning ownership, it is not surprising to find that SMEs belonging to the test sample are nearly exclusively independent. Only 1.3% are externally owned up to the maximum share of 25% allowed to be classified as 'SME'. But this is also very similar in the case of the SMEs of the control sample (4.8% with a 25%-share). In the case of the firms which are not SMEs, 36.7% are independent, 8.3% have a participation up to 50%, and 55% are externally controlled (up to 100%).

SMEs are predominantly young, mostly founded since 1980. In the test sample 45.9% were established in the 1990s, 18.9% in the 1980s, and 24.3% after the war. In the control sample this applies to 44.3% (1990s), 9.8% (1980s), and 34.4% (postwar). Very few firms were founded during the war or before. Those firms which are not SMEs tend to be older, but nevertheless, by far most of them were also established after the war (80.7% in total, 31.6% since 1990). The war period was not a time of significant firm foundation, in spite of the military-oriented industrial development in Upper Austria (see chapter 4.4 of part I).

The next figure (III.1) shows that the industrial structures of the subsets are very different. Test-SMEs belong most frequently to the industries 'metal and metal products', 'machinery', and

'engineering'. Many of them are also manufacturing plastic products and offering data processing services. The control-SMEs are predominantely engineering firms. In the case of firms which are not SMEs the structure is more equally distributed; most important are electrical equipment and electronics, machinery, metal (products), vehicles (components), and plastic products.

Figure III.1: Industries of the responding firms (in %)



Source: SMEPOL-survey

In all subsets customer specified production is predominant, but least in the case of the test-SMEs. These firms are very strong in flexible small batch production. As to be expected, mass production of standardized products is rare in the SME-sector, both belonging to the test and the control sample. This production regime is most frequent in larger or dependent firms.

Table III.5: Production regime (% of firms)

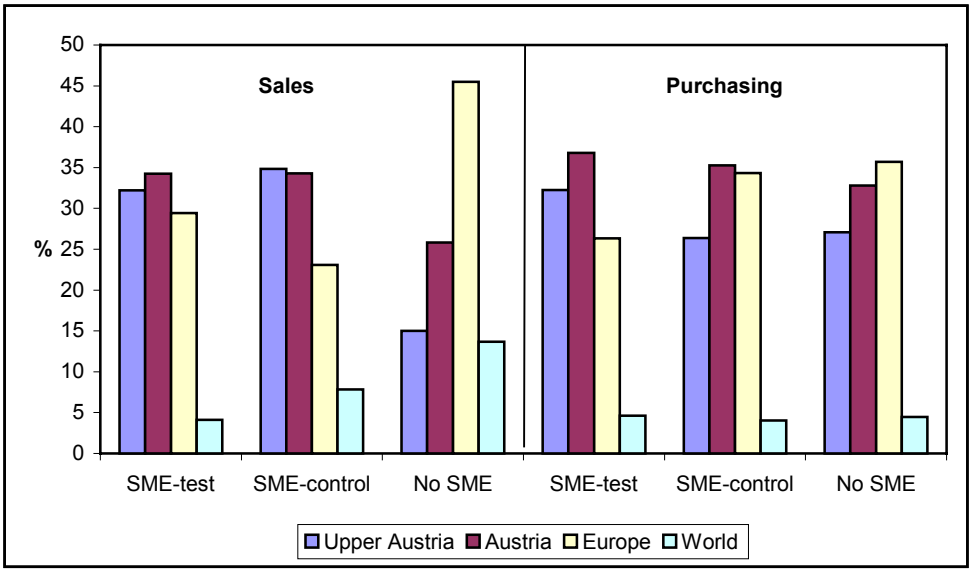
	SME-test	*SME-control*	*No SME*
Standardized mass production	24.4	17.7	38.1
Flexible small batch production	46.2	33.9	47.6
Customer specified production	64.1	69.4	71.4

More than one production regime in the same firm possible.

Source: SMEPOL-survey

Finally, there are remarkable differences in the spatial distribution of markets between the subsets. The following figure shows that SMEs sell their products primarily to the regional and national markets, whereas the large/dependent firms are clearly oriented towards the European markets. The most regionally-oriented group is the SME-control sample. As far as purchasing of inputs is concerned, the most important spatial level for SMEs is Austria. In contrast to sales, the test-SMEs have the highest share of regional purchases. Outside the SME-sector, the European level is again the most important one, but the difference is less.

Figure III.2: Output and input markets (average share of spatial levels in the firms' input and output markets)



Source: SMEPOL-survey

2 Innovativeness

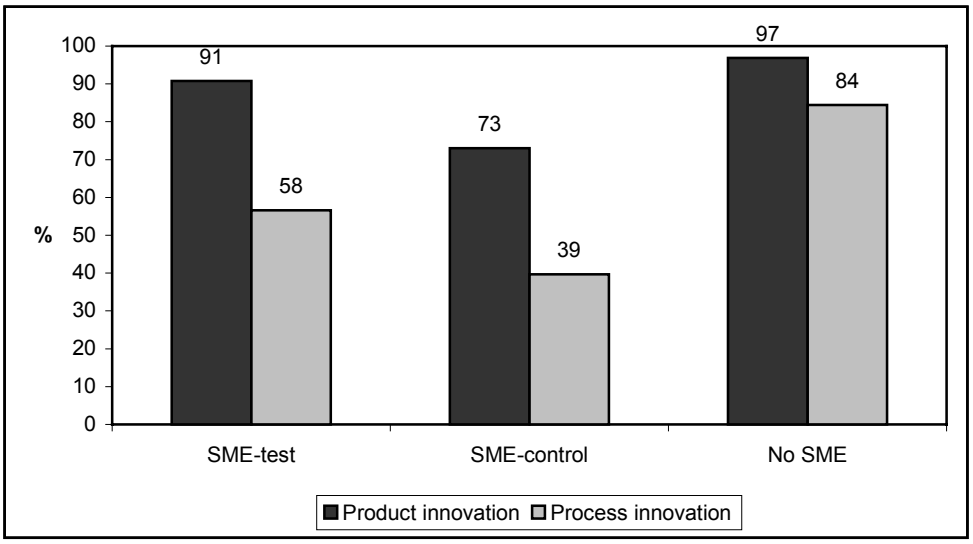
In this section we are going to analyze the innovativeness of Upper Austrian SMEs in the last three years, comparing the data for SMEs of the test and control samples and firms which are not SMEs. The assessment of innovativeness will be based on the results of the innovation activities (i.e., product and process innovations), organizational changes, the innovation processes (inputs and stages), and the role of innovation as a strategy of competition. Most results come from the company survey, but we have also used additional information from the Austrian 'Technology and Innovation Test' (Leo, 1992).

2.1 The output of the innovation activities

Looking at the results of the innovation activities, we find that the most innovative firms are those which are not SMEs. They are even slightly more innovative than the SMEs of our test-sample. Nevertheless, due to the fact that the test-firms are currently receiving or have recently received support for innovative activities, nearly all of them have introduced some kind of innovation, either regarding products or processes. Only four companies could not mention any innovation. Three of

them are located in facility-oriented technology centres, offering services without having changed them in the recent past. One firm is still in the process of innovation without having reached the final step of commercialization. In comparison, SMEs belonging to the control sample (i.e., which have not been supported by the investigated instruments) are clearly less innovative.

Figure III.3: Frequency of product and process innovations (% of firms)



Innovations within the last three years.

Source: SMEPOL-survey

In general, product innovations are more frequent than process innovations. The difference between these categories, however, is much bigger in the case of SMEs than the other firms. Product and process innovations are rather general categories. Therefore, table III.6 shows the frequency of more detailed types of innovations.

As far as product innovations are concerned the results are unambiguous: The SMEs of the test sample have more advanced innovations than the other subsets. They have the highest frequency of products which are new to the market (and not only to the firm) and the lowest of minor modifications. Additionally, these are the firms where the innovative products have the highest share in total sales on average.

In the case of process innovations, the most active subset of firms is that of the large/dependent firms. In this group of firms the development of new technologies is nearly as frequent as the adoption of existing technologies. The primary motive for introducing new processes is improving productivity. As far as SMEs are concerned, those of the control sample concentrate primarily on the adoption of existing technologies in order to improve quality and productivity. The test-SMEs are relatively more engaged in the development of new technologies than the control-SMEs. Their most important motives are an adequate technological basis for new products and the improvement of quality. Once again, this is evidence of the higher degree of innovativeness of the SMEs of the test sample compared with those of the control sample.

Table III.6: Types of innovations (valid % of firms)

	SME-test	*SME-control*	*No SME*
Types of product innovations:			
Modifications	55.7	72.7	71.1
New products in the firm's product range	75.7	63.6	77.5
Products new to the market	64.3	40.9	62.9
Share of innovative products in total sales:	39.4	26.0	26.1
Types of process innovations:			
Adoption of existing technologies	66.7	82.6	69.8
Development of new technologies	55.6	39.1	67.9
Motives for new technologies:			
Improving productivity	60.0	69.6	68.6
Flexibilization of production	35.6	43.5	40.8
Improving quality	60.0	78.3	53.8
Technological basis for new products	68.9	26.1	53.8

More than one type of innovation in the same firm possible.

Source: SMEPOL-survey

There are also innovation differences by size and industry of SMEs (both belonging to the test and the control sample):

Table III.7: Product and process innovations by type of SME (% of SMEs)

	n	*Product innovations*	*new to the market*	*Mean share of new products*	*Process innovations*	*newly developed*	*Tech. base for new products*
Employees:							
1 - 9	55	70.9	45.5	46.5	34.5	14.5	25.5
10 - 49	40	87.5	47.5	35.0	52.5	32.5	25.0
50 - 249	40	95.0	45.0	21.9	65.0	30.0	27.5
Industry:							
Wood / furniture	16	87.5	43.8	18.5	62.5	31.3	18.8
Plastic products	9	100.0	66.7	42.4	88.9	88.9	55.6
Metal (products)	18	88.9	38.9	27.0	77.8	33.3	38.9
Machinery	23	95.7	56.5	42.0	34.8	13.0	26.1
Electro(nics)	10	90.0	40.0	27.8	70.0	20.0	50.0
Producer services	48	64.6	35.4	40.3	29.2	12.5	16.7

Source: SMEPOL-survey

The larger the SMEs, the more frequent are product and process innovators. But this does not apply to all categories of innovations. With regard to products which are new to the market, there is hardly a difference. It is also nearly the same share of firms which has introduced new technologies

in order to be able to develop or manufacture innovative products. Technologies developed by the firms themselves are only rare in the case of the smallest SMEs. In contrast to the introduction of innovations, the share of innovative products decreases with the size of firms. Therefore, the general impression that larger SMEs are more innovative than smaller ones cannot be accepted for all innovation indicators.

Concerning the industry differences we find that most innovative companies are manufacturers of plastic products (often using advanced materials), producers of machinery, and manufacturers of electrical equipment and electronics, both regarding product and process innovations. Relatively strong process innovators are, in addition, firms of the metal and metal products-industry. Producer services are, generally, weak innovators. But if they have introduced innovations, then the share of the innovative services in total sales is high.

The results of the survey that product innovations are more frequent than process innovations and that smaller firms tend to be less innovative than larger firms (if the level of innovativeness is not regarded) is confirmed by several studies; for example, the recent TSER-project "REGIS" (Cooke et al., 1998) as well as the most comprehensive innovation study on Austrian manufacturing companies available at present, the "Technology and Innovation Test" (Leo, 1992).

Table III.8: Share of plants with types of innovation differentiated by plant size in Austria (1990 in %)

Number of employees:	*Total innovations*	*Product innovations*	*Process innovations*
< 50	33.5	30.0	19.3
≥ 50 and < 200	64.7	57.0	42.9
≥ 200 and < 500	82.2	71.3	60.4
≥ 500 and < 1000	97.4	89.5	79.0
≥ 1000	88.4	81.4	69.8
Total	60.9	54.2	42.3

Source: Leo, 1992

Interpreting the sectoral differences in innovativeness (see table III.9) we find that the high frequency of product innovations in our survey can be partly explained by the industrial structure of our samples. Three of the four industries to which most of the SMEs in our survey belong are very innovative in all of Austria: electrical equipment and electronics, machinery, and metal products. They account for more than a third of the group of SMEs. The plastics-sector seems to be an exceptional case: SMEs of this industry in our survey are more innovative than in Austria.

Table III.9: Innovativeness of manufacturing industries in Austria (1990)

Industries:	*Share of plants with innovations (in %)*	
Musical instr., toys, sports eq.	100.0	
Chemicals	85.4	
Shoes	71.4	**more**
Electro, electronics	70.5	
Machinery	67.4	**innovative**
Transport	66.7	
Metal products	66.7	
Textiles	64.3	
Total	**60.9**	
Metal / steel	60.7	
Wood products	58.1	
Medical, optical instruments	57.1	
Paper	54.6	**less**
Rubber, plastics	54.2	
Beverages, tobacco	52.6	**innovative**
Food products	50.0	
Ceramics	48.0	
Clothes	19.2	

Shaded: The 4 most frequent manufacturing industries of the SME-sector in our survey.

Source: Leo, 1992

So far we have analyzed product innovations and the introduction of new processes from a technological perspective. Now we will look at the organizational changes in the repondents' firms:

Table III.10: Organizational innovations

	SME-test	*SME-control*	*No SME*
Any organizational innovations (% of all firms):	66.7	56.5	84.4
Types (valid % of firms):			
Outsourcing, subcontracting	25.5	40.0	30.6
Flexibilization	37.3	48.6	36.4
Quality management	52.9	37.1	72.9
Decentralization	11.8	20.0	24.7
Networking	68.6	60.0	78.6

More than one organizational innovation in the same firm possible.

Source: SMEPOL-survey

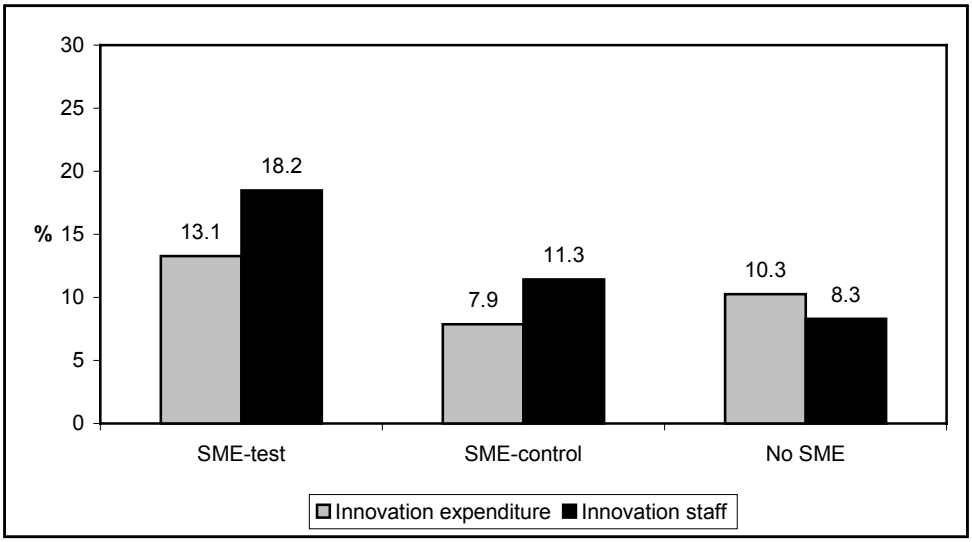
Most active with respect to organizational changes are large or dependent firms, least active the SMEs of the control sample. For all firms the most important focus is on networking (i.e., linking to existing computer networks or establishing internal/external computer networks). For the

large/dependent firms and the test-SMEs it is followed by quality management. The pattern is different for the control-SMEs where flexibilization and outsourcing/subcontracting are more important in comparison. The control-SMEs tend to be behind the most recent organizational developments which have been already implemented by most of the test SMEs and large/dependent firms.

2.2 Inputs into the innovation process

The next figure shows the relative importance of inputs into the innovation process. It presents the average ratios of manpower (personnel), primarily engaged in innovation, to total employment and innovation expenditures to turnover. Because of the fact that many employees which contribute to the innovation process of a firm are not engaged in these activities exclusively, the respondents were asked to estimate the time dedicted to innovation of their employees ("full-time equivalent"). For example, a firm with two employees spending 50% of their working hours each for innovation-related activities disposes of a full-time equivalent innovation manpower of 1.

Figure III.4: Innovation inputs (average ratios 'innovation budget/turnover' and 'innovation staff/number of employees')



Source: SMEPOL-survey

In the case of SMEs the innovation staff is relatively more important than the innovation budget, for larger firms it is the opposite. In SMEs, due to the small size of the firms, a higher percentage of the employees is (most often part-time) involved in the innovation process. Of course, staff which is primarily engaged in innovation in absolute terms depends on the size of the firms. Confirming the results about introduced innovations, we see that the SMEs of the test sample employ more resources for the innovation process than the SMEs of the control sample.

The development of innovation budget and personnel within the last three years is most expansive in the large/dependent firms. But the SMEs of the test-sample follow quite closely, in particular with respect to expenditures. On the contrary, most of the control-SMEs show a stagnant

development, especially as far as manpower is concerned. More than two thirds of these SMEs keep their efforts in terms of manpower constant, and another 12% are even reducing it.

Table III.11: Tendency of innovation inputs (valid % of firms)

	SME-test	*SME-control*	*No SME*
Expenditures:			
Increasing	63.0	41.7	75.4
Constant	34.2	50.0	24.6
Decreasing	2.8	8.3	0.0
Staff:			
Increasing	50.0	18.8	60.7
Constant	47.2	68.8	37.7
Decreasing	2.8	12.5	1.6

Source: SMEPOL-survey

The following table shows innovation inputs for different size-classes and industries:

Table III.12: Innovation inputs by type of SME (mean ratios and % of SMEs)

	Relative innovation budget (mean)	*Increasing tendency (%)*	*Relative innovation staff (mean)*	*Increasing tendency (%)*
Employees:				
1 - 9	18.2	29.1	33.3	16.4
10 - 49	8.9	55.0	8.9	45.0
50 - 249	6.1	62.5	2.9	40.0
Industry:				
Wood / furniture	7.0	56.3	1.7	31.3
Plastic products	18.0	77.8	13.5	22.2
Metal (products)	5.6	55.6	4.9	38.9
Machinery	7.2	56.5	10.3	65.2
Electro(nics)	7.9	10.0	17.2	20.0
Producer services	17.0	43.8	31.6	20.8

Source: SMEPOL-survey

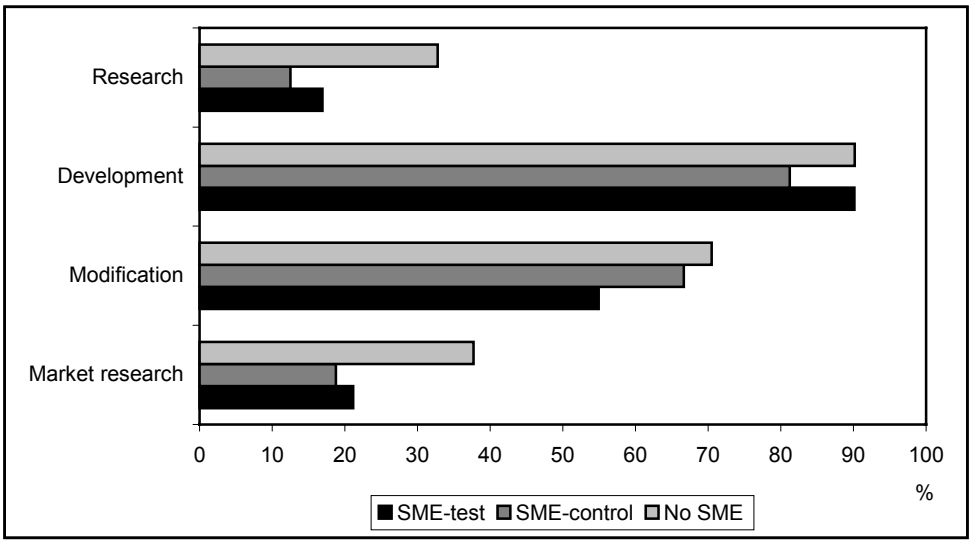
Innovation inputs in relative terms decrease with company size. Relative innovation budgets and, especially, staff are clearly largest in the case of the smallest SMEs, partly due to indivisibilities. As far as industries are concerned, manufacturers of plastic products have the highest budgets in relative terms, producer services and electronics the highest share of manpower available for innovation. Regarding the tendency of innovation budgets, in all industries except for electro/electronics most firms are expanding, most strongly in plastics. As far as staff is concerned, the frequency of firms with increasing staff is in most industries lower. A significant exception is machinery, with nearly two thirds of (responding) SMEs increasing their innovation staff.

Not surprisingly, we find that the most innovative industries tend to employ the highest innovation inputs in relative terms (plastics, electro/electronics, machinery). This does not apply, however, to producer services with less firms being innovative; but those which have introduced innovations employ a lot of their resources for this purpose.

2.3 The scope of the innovation process

In order to get a more detailed understanding of the quality of innovations, we can also look at the scope of the innovation activities performed:

Figure III.5: Phases of the innovation process (valid % of firms)



Source: SMEPOL-survey

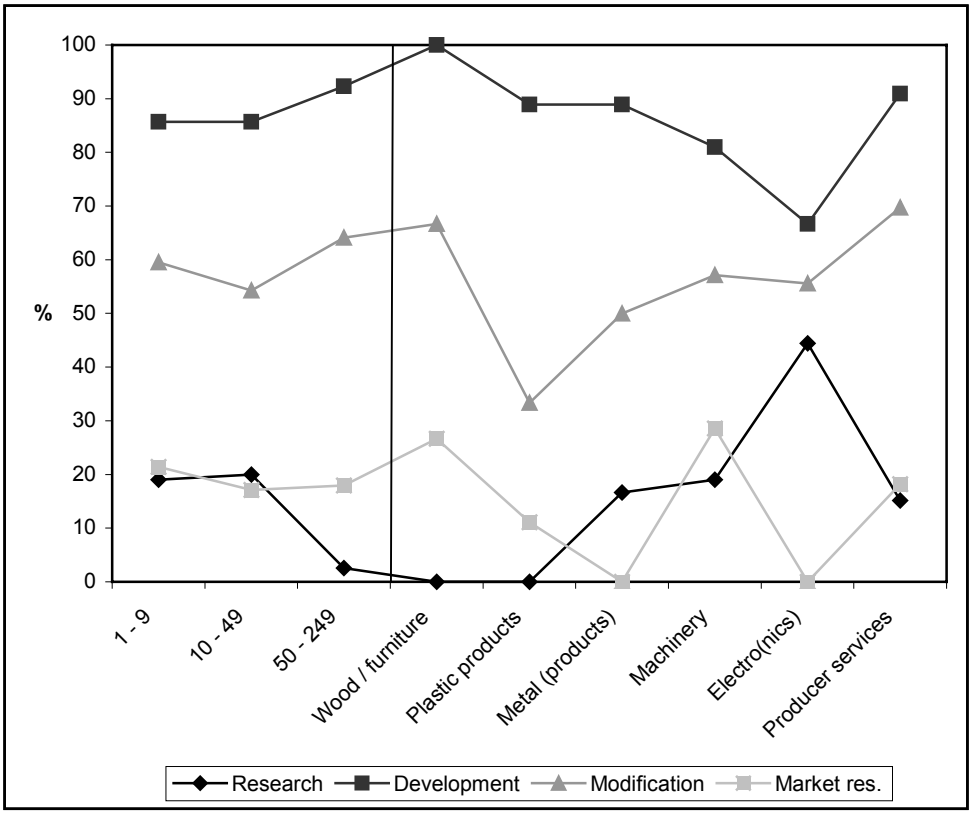
The respondents were asked to indicate which phases of the innovation process are performed in their firm. We operationalized the term 'research' as development of concepts or models which are several years away from their commercalization. The activities which are necessary to make a new product or technology ready for the market are considered 'development'. Improvements of existing products or technologies are summarized as 'modification'. Systematic activities to get information what customers need or want were classified as 'market research'.

Overall, the most frequent activity is development which is actually more often performed than modification (nevertheless ranking second in all subsets). This means that many innovations are really newly developed products and not only modifications of old products. On the other hand, it means that there are several firms which have not modified products having been on the market for some time already. In this context it has to be considered that a lot of the responding firms are very young (see chapter 1.2 of part III) and, therefore, do not have "old" products. Research is most frequently performed in those firms which are not SMEs. In general, they have the most "complete" innovation process. This is not surprising considering the fact that 60% of them are large companies with more than 250 employees (see table III.4) having a corresponding broad range of products and activities.

Within the SME-sector the test-sample is more active in research and development, but less in modification. The test-SMEs are also more frequently performing market research. There are again differences between these two groups of SMEs supporting the view that those receiving or having received support are more innovative.

As the following figure shows, there are big differences by size and industry of SMEs as far as the performed activities of the innovation process are concerned:

Figure III.6: Phases of the innovation process by type of SME (valid % of SMEs of the respective set)



Source: SMEPOL-survey

Regarding differences by size, the largest SMEs are the least active "researchers", but also most strongly engaged in development and product modification. The most research-intensive industry is clearly electro/electronics, the least active are wood products and furniture, but also plastics. SMEs of the latter industry are also hardly engaged in product modification. In many electro/electronic-firms development is not performed. Obviously, some of these respondents used a rather extensive concept of research including activities which are normally considered as development. Market research is in all subsets rather rare, especially in the metal- and electro(nics)-industries. Many SMEs seem to be involved in close customer-supplier-relationships being of the opinion that systematic collection of market information beyond these relations is not necessary.

There is no clear correlation between innovativeness and innovation inputs on the one hand and phases of the innovation process on the other. We have seen that the most innovative industries are plastics, machinery, and electrical equipment/electronics. From these industries, manufacturers of

plastic products do not perform research, whereas firms of the electro(nics)-industry are the most active ones regarding research.

The Austrian "Technology and Innovation Test" (Leo, 1992) made a more comprehensive analysis of the phases in the innovation process. In this test more innovation-related activities were covered and their share in total innvation expenditures was investigated.

Table III.13: The importance of certain innovation activities in Austria (shares in total innovation expenditures in % *)

Number of employees:	*Research*	*Develop-ment*	*Construct-ion*	*Design*	*Invest-ments*	*Marketing*	*Production*	*Admini-stration*
< 50	13.2	21.1	7.6	23.6	12.2	6.6	8.5	4.3
≥ 50 and < 200	13.8	26.2	10.7	4.9	12.3	6.8	12.4	6.8
≥ 200 and < 500	13.2	23.4	13.9	9.7	13.6	5.4	11.2	2.9
≥ 500 and < 1000	11.9	26.4	14.7	5.4	10.9	5.2	15.5	5.0
≥ 1000	16.4	31.9	7.7	3.9	12.0	1.7	13.7	3.4
Total	13.5	24.9	11.0	10.1	12.5	5.9	11.6	4.9

* Difference to 100% due to other types of expenditures.

Source: Leo, 1992

There are some similarities with our survey: The most important innovation-related expenditures are those for the development of a product. Obviously little concern is directed to the marketing of an innovation. Innovation activities are predominantly incremental and technology-oriented. The share which is spent for research is relatively high. It is most important in the large companies, but also the small and medium-sized firms have high shares of research. In our survey the difference between the frequency of development and research is far larger. This can be partly explained by the fact that research is often relatively more expensive than development requiring a overproportional share of the innovation budget. A significant result is the high percentage of design in the case of small firms. This represents quite well the typical customer specified service character of many small firms' business activities.

2.4 The role of innovation as a strategy of competition

To what extent is innovation a strategy of the firms to gain competitive advantages? The following table (III.14) shows that innovation has become a widely recognized strategy of competition:

Table III.14: Goals of and motives for innovation (valid % of firms)

	SME-test	*SME-control*	*No SME*
Competitive advantage	90.5	84.3	90.0
Quality advantage	62.2	52.9	45.7
Specialization (market niche)	67.6	62.7	55.6
Diversification	21.6	19.6	24.4
Cutting cost, improving productivity	47.3	47.1	70.2

Several goals or reasons in the same firm possible.

Source: SMEPOL-survey

Other objectives or motives for innovation differ between small and large firms. In the case of SMEs, specialization on market niches and gaining advantages in product quality are also very frequent; correspondingly, diversification is only for few firms important. The rank order is the same for both SME-samples, but the frequencies are higher in the case of the test-SMEs. For firms which are not SMEs, cutting cost and improving productivity is the second most frequent motive for innovation, clearly surpassing other reasons. In general, it is obvious that innovation is more often part of a strategy which concentrates on a small, highly specialized market niche than a strategy to diversify the product range and to enter into new markets. Overall, innovation seems to have a defensive character in Upper Austrian companies, relying on the experience accumulated in certain technologies without trying to use it to open up new market opportunities.

3 Problems and barriers constraining the innovation process

The respondents were asked to indicate which problems out of a list of ten potential internal and external factors constrain or even prevent their innovation activities. Two levels of interference have been distinguished: impeding (e.g., increasing the costs or extending the time of an innovation project) or preventing the start or the successful completion of an innovation project. The answers have to be interpreted as negative impacts on certain, but not necessarily all, innovation activities of a firm. This means that preventing factors are project-specific, but nevertheless serious limitations for the innovativeness of firms. This explains why it is no contradiction that the frequency of preventing factors and the frequency of innovations sum up to more than 100%. This would be impossible, if the indicated factors would actually prevent any kind of innovation. Interpreting the data presented in the next table, it should be considered that only very few firms (16) responding to the survey have not introduced any innovations in the last three years. All of them are SMEs (one is a dependent subsidiary); and they are mainly engineering firms.

Table III.15: Factors impeding or preventing innovation activities (valid % of firms)

	SME-test			*SME-control*			*No SME*		
	!!	*!*	*0*	*!!*	*!*	*0*	*!!*	*!*	*0*
Lack of finance	26.0	43.8	30.1	27.3	41.8	30.9	16.1	53.2	30.6
Risk impossible to be taken	27.1	42.9	30.0	34.8	32.6	32.6	30.5	37.3	32.2
External demands dominating	7.9	42.9	49.2	11.4	45.5	43.2	3.9	54.9	41.2
Customer requires secrecy	3.3	13.1	83.6	8.9	24.4	66.7	3.7	24.1	72.2
Lack of technical know-how	4.7	28.1	67.2	13.0	26.1	60.9	5.6	37.0	57.4
Technology inavailable*	7.6	50.0	42.4	27.3	36.4	36.4	16.1	44.6	39.3
Marketing problems	3.1	58.5	38.5	17.0	46.8	36.2	5.5	49.1	45.5
Lack of qualified personnel	10.0	57.1	32.9	17.0	44.7	38.3	8.9	51.8	39.3
Lack of time	10.0	69.0	21.1	25.5	60.0	14.5	14.5	70.9	14.5
No need to innovate	8.6	5.2	86.2	5.0	12.5	82.5	15.7	5.9	78.4

!!: preventing factor, !: impeding factor, 0: no barrier

* Adequate technology is missing or too expensive.

Source: SMEPOL-survey

Which are the most serious problems? For firms of all samples it is difficult to take the risk of an innovation project. Considering the fact that a lack of technical know-how does not belong to the most serious problems, it seems to be the commercial risk which is often a strong barrier constraining innovation. Insufficient funds are also a general problem; especially for SMEs it is often preventing innovation. The third general constraint is the lack of time. This problem is most serious in the case of the control-SMEs, but also for most of the large/dependent firms it is impeding their innovation activities. The test-SMEs are slightly less affected by this problem.

Less frequent problems are the inavailability of qualified personnel, problems of marketing and commercialization, dominating external demands (especially those of customers), and inavailable (missing or too expensive) technology. Very few firms in all three subsets considered innovation as unnecessary. This corresponds to the high level of awareness of the crucial role of innovation for competitiveness described in chapter III 2.4. A rare problem is also secrecy demanded by customers. The lack of technical know-how is for a number of firms an impeding constraint, but obviously not one of the most serious.

There are some differences between the samples to be observed: SMEs of the test sample and large/dependent firms indicated factors more often as ‘impeding’ while control-SMEs assessed more as ‘preventing’. Nevertheless, sample-specific problems are rare. For SMEs of both subsets a typical problem seems to be marketing, for SMEs of the control sample this applies to inavailable technology, and for the test-SMEs a specific problem seems to be the lack of qualified personnel.

More and larger differences regarding barriers for innovation appear, when we differentiate between size classes and industries of SMEs:

Table III.16: Barriers for innovation by type of SME (valid % of SMEs)

	Size			*Industries*					
	1 - 9	*10 - 49*	*50 - 249*	*Wood / furniture*	*Plastic prod.*	*Metal (prod.)*	*Machin.*	*Electro (nics)*	*Producer services*
Preventing problems:									
Lack of finance	42.0	11.4	21.1	20.0	33.3	6.3	31.8	30.0	34.1
Risk impossible to be taken	39.1	24.1	27.0	35.7	33.3	20.0	27.8	20.0	37.8
External demands dominating	14.3	7.7	5.7	0.0	12.5	0.0	0.0	11.1	17.1
Customer requires secrecy	9.1	4.0	2.9	0.0	0.0	0.0	0.0	0.0	13.9
Lack of technical know-how	6.7	17.9	2.9	0.0	25.0	7.1	6.7	10.0	5.4
Technology inavailable	11.9	20.0	17.6	14.3	25.0	13.3	6.7	11.1	16.7
Marketing problems	11.6	10.7	5.3	26.7	0.0	0.0	0.0	11.1	11.1
Lack of qualified personnel	13.0	19.4	8.3	7.7	0.0	12.5	11.1	20.0	13.2
Lack of time	18.0	17.1	16.2	7.1	12.5	5.9	17.4	50.0	14.6
No need to innovate	5.0	12.5	6.5	8.3	12.5	0.0	0.0	0.0	12.1
Impeding problems:									
Lack of finance	34.0	57.1	39.5	40.0	44.4	50.0	54.5	30.0	43.2
Risk impossible to be taken	30.4	41.4	45.9	14.3	44.4	46.7	50.0	40.0	37.8
External demands dominating	50.0	38.5	45.7	53.8	75.0	40.0	40.0	55.6	40.0
Customer requires secrecy	18.2	16.0	20.6	30.8	42.9	0.0	26.7	30.0	8.3
Lack of technical know-how	26.7	17.9	35.3	16.7	25.0	14.3	20.0	40.0	35.1
Technology inavailable	40.5	40.0	52.9	64.3	62.5	46.7	33.3	55.6	36.1
Marketing problems	55.8	46.4	57.9	33.3	75.0	62.5	71.4	22.2	58.3
Lack of qualified personnel	52.2	48.4	58.3	38.5	87.5	56.3	61.1	40.0	60.5
Lack of time	68.0	65.7	62.2	64.3	87.5	76.5	73.9	30.0	73.2
No need to innovate	12.5	4.2	6.5	8.3	0.0	0.0	6.7	0.0	12.1

Source: SMEPOL-survey

Specific problems for the smallest SMEs are a lack of finance, too high risk of innovation projects, and demands of customers (including secrecy). Technical problems (lack of know-how and equipment) and the lack of qualified personnel is more frequent in the case of firms between 10 and 49 employees. Larger SMEs are, in general, less affected by problems (except for technological problems).

Regarding industries, we are confronted with several problem patterns, allowing hardly any general interpretations. It shows that one should be careful with general statements about problems and deficits in the innovation processes of SMEs. This sector consists of very different types of firms with often very specific problems. This will be important when designing SME-support programmes.

A further interesting question is, whether SMEs with a higher or a lower degree of innovativeness have different barriers. For this purpose we have applied three criteria of measuring innovativeness: 'introduction of products which are new to the market' versus 'products which have been modified or are new for the firm only'; 'technologies developed by the firm itself' versus 'adopted

technologies'; 'average share of innovative products in total sales' (above or below the average share of all innovative SMEs).

Table III.17: Barriers for innovation by type of innovator (valid % of SMEs)

	Products new to market	*Products modified or new for firm only*	*Newly developed technologies*	*Adopted technologies only*	*Share of innovative products above average**	*Share of innovative products below average**	*SMEs without innovation*
n =	63	51	34	34	36	71	15
Preventing problems:							
Lack of finance	25.4	22.9	29.4	15.6	25.7	24.6	50.0
Risk impossible to be taken	31.5	25.6	31.3	27.6	35.5	26.2	66.7
External demands dominating	9.4	2.8	16.7	3.4	10.0	7.5	28.6
Customer requires secrecy	1.9	2.8	6.9	0.0	3.6	3.7	25.0
Lack of technical know-how	3.8	12.5	10.0	6.7	6.7	8.8	12.5
Technology inavailable	11.1	18.9	20.7	6.7	7.1	17.5	22.2
Marketing problems	3.7	12.2	3.2	13.3	3.7	9.7	42.9
Lack of qualified personnel	7.4	19.6	3.2	26.7	16.7	9.5	28.6
Lack of time	8.8	22.9	9.7	25.8	12.1	16.9	45.5
No need to innovate	6.1	8.8	10.7	3.8	11.1	3.8	16.7
Impeding problems:							
Lack of finance	44.1	45.8	41.2	46.9	51.4	38.5	30.0
Risk impossible to be taken	38.9	46.5	43.8	37.9	38.7	42.6	22.2
External demands dominating	50.9	41.7	46.7	44.8	53.3	41.5	28.6
Customer requires secrecy	21.2	19.4	24.1	10.7	10.7	27.8	12.5
Lack of technical know-how	21.2	40.0	20.0	23.3	26.7	31.6	37.5
Technology inavailable	53.7	35.1	41.4	53.3	39.3	50.9	44.4
Marketing problems	55.6	56.1	54.8	50.0	59.3	56.5	42.9
Lack of qualified personnel	48.1	56.5	61.3	40.0	53.3	52.4	71.4
Lack of time	73.7	64.6	64.5	48.4	72.7	67.7	54.5
No need to innovate	8.2	5.9	0.0	3.8	0.0	11.5	33.3

* Average share of innovative products in the case of SMEs: 33.9%

Source: SMEPOL-survey

Interpreting this table we find some interesting differences: As to be expected, the non-innovators have the highest frequencies of "preventing problems". The lack of innovation in their case is not so much caused by "no need to innovate" but more by other problems such as a too high risk, a lack of finance and of time, as well as marketing problems. But also the innovating firms are confronted with barriers, but they differ between the types of innovators. For the more advanced innovators (those having products new to market or newly developed technologies) the high risk of innovation projects and the lack of finance are often considered as preventing problems. Less serious ("impeding") but still frequent are a lack of time and marketing problems. For advanced product innovators, furthermore, inavailable technology as well as dominating external demands are impeding problems. For product modifiers and technology adopters the pattern looks different. The adopters seem to face less problems in general: a lack of qualified personnel, a lack of time, and

marketing problems are the most relevant in comparison. For the modifiers it is this same group of factors, and, in addition, they are lacking relevant technology and know how.

How do these results compare to the Austrian "Technology and Innovation Test" (Leo, 1992)? The most important types of problems there are a lack of equity capital, limited domestic demand, uncertain market development, and too high innovation expenditures. Further problems are a lack of (adequately qualified) production- and R&D-personnel and too long pay-off-periods. Items like co-operation, know-how, willingness to innovate are rarely seen as problems. The list of items is different from that used in our survey. But the importance of financial problems (lack of equity capital, too high innovation expenditures) seems to be similar. Obviously, market-related problems (lack of domestic demand, uncertain market development) might be more serious than it appears from our survey, because we dedicated only one item (marketing problems) to this aspect.

Table III.18: The three most frequent innovation-related problems in Austria, frequency of the most important one in % *

Number of employees:	*Frequency of top problem*	*Problems:* *most frequent*	*2nd frequent*	*3rd frequent*
< 50	54.4	Lack of equity capital	Lack of loans	Lack of domestic demand
≥ 50 and < 200	41.1	Lack of equity capital	Lack of domestic demand	Recruiting of production personnel
≥ 200 and < 500	36.6	Lack of domestic demand	Pay-off period too long	Uncertain market development
≥ 500 and < 1000	38.1	Lack of domestic demand	Uncertain market development	Pay-off period too long
≥ 1000	51.1	Innovation expenditure too high	Uncertain market development	Pay-off period too long
Total	39.2	Lack of equity capital	Lack of domestic demand	Uncertain market development

* Several problems could be mentioned by the same respondent.

Source: Leo, 1992

The results of the Austrian study lead to the conclusion that there are not many remarkable differences between the problem patterns of size classes. Most of the serious problems are market-(demand-) related. However, the lack of equity capital which can be used for risk investments is obviously a typical problem of smaller firms. That innovation is too expensive is primarily a problem of large firms, obviously due to the more advanced character of many of their innovation projects. Additionally, the closely related problem of the pay-off period of innovation investments is also more frequent in medium-sized and large firms.

4 Partners in the innovation process

In this chapter we are going to analyze the external relations of firms as far as they concern the innovation process. The respondents were asked to indicate all kinds of cooperations contributing to the firms' innovation activities. They were further asked to differentiate between occasional collaborations of minor importance and continuous or frequent cooperations yielding important contributions to the innovation projects. Table III.19 shows the frequencies of certain types of partners for the subsets differentiated by the spatial level of the partners' locations. The upper part of the table presents the frequency of important cooperations, the lower part all collaborations disregarding their importance.

In general, we find that important cooperations are rather rare. In the case of most innovation partners, their frequency is about half or less of occasional contacts. Only in the cases of customers and suppliers from regional to European levels as well as public support at the national level important cooperations have been indicated more frequently.

Which patterns of innovation partners can we observe? Innovation collaborations with other companies are, generally, most frequent. Customers rank first, suppliers second, services third. In the case of the SMEs, customers, service and other firms are most often located in the region, slightly less in Austria. Regarding cooperations with customers and suppliers we find that the control sample (which consists of less innovative firms) is more confined to the region than the test sample. Large or dependent firms as a contrast are more oriented towards the European and national level, except for cooperations with service firms which are mainly regional.

Innovation partners from science are less frequent than customers and suppliers, but, nevertheless, a remarkable share of large/dependent firms and test-SMEs have some relations, especially with universities. Large/dependent firms are the most active collaborators with science, followed by the test-SMEs. This differs from the control-SMEs where we find no important relations at all. Due to the fact that Upper Austria does not have a technical university, universities at the national level are the most important for all subsets; for the test-SMEs the university of Linz ranks second, for large/dependent firms European universities are more important. Research organizations are generally less important which is not surprising, because there are not many independent research institutions in Austria.

Technology centres are, in general, rarely used and if so it is more often within the region. Interestingly, the large/dependent firms have more relations with technology centres than the test-SMEs, whereas the control firms do not interact with these centres at all. Training institutions are more relevant innovation partners than technology centres, again primarily those located in the region.

Except for customers and suppliers, the providers of support programmes are the most important innovation partners. Control-SMEs interact primarily with regional organizations, test-SMEs as well as large/dependent firms first with national, second with regional and third with European institutions. The data show that - again - the large/dependent firms are interacting with support institutions more frequently than the test and control firms do.

Table III.19: Innovation partners of the firms and their locations (valid % of firms)

	SME-test				*SME-control*				*No SME*			
	Upper A.	*Austria*	*Europe*	*World*	*Upper A.*	*Austria*	*Europe*	*World*	*Upper A.*	*Austria*	*Europe*	*World*
Important, continuous cooperation:												
Customers	34.2	26.0	27.4	5.5	40.8	28.6	24.5	8.2	25.8	29.0	46.8	16.1
Suppliers	21.9	20.5	30.1	4.1	26.5	12.2	24.5	6.1	17.7	22.6	30.6	11.3
Other firms	11.0	5.5	4.1	4.1	2.0	2.0	2.0	0.0	1.6	3.2	8.1	6.5
Service firms	13.7	6.8	5.5	1.4	14.3	4.1	4.1	2.0	12.9	9.7	4.8	4.8
Universities	6.8	11.0	4.1	1.4	0.0	0.0	0.0	0.0	12.9	29.0	16.1	3.2
Research organizations	5.5	9.6	2.7	1.4	0.0	0.0	0.0	0.0	6.5	12.9	16.1	4.8
Technology centres	5.5	1.4	2.7	0.0	0.0	0.0	0.0	0.0	9.7	6.5	4.8	0.0
Training institutions	8.2	4.1	2.7	0.0	2.0	0.0	0.0	0.0	11.3	3.2	3.2	0.0
Public support	9.6	27.4	2.7	0.0	0.0	0.0	0.0	0.0	16.1	38.7	16.1	0.0
Any contacts:												
Customers	64.3	60.2	54.8	19.2	59.2	51.0	38.8	20.4	51.6	58.0	77.4	37.1
Suppliers	41.1	46.5	43.8	10.9	38.7	30.6	40.8	10.2	51.6	53.2	66.1	21.0
Other firms	17.8	16.5	13.7	5.5	20.4	12.2	12.2	6.1	4.8	16.1	27.5	14.6
Service firms	27.4	23.2	13.7	2.8	28.6	16.3	6.1	2.0	35.5	29.1	27.4	9.6
Universities	21.9	31.5	16.4	5.5	6.1	10.2	2.0	0.0	32.3	61.3	35.5	9.7
Research organizations	9.6	16.4	6.8	4.1	4.1	6.1	2.0	0.0	13.0	35.5	25.8	9.6
Technology centres	13.7	9.8	5.4	1.4	0.0	2.0	0.0	0.0	25.8	22.6	11.3	1.6
Training institutions	19.2	16.4	2.7	0.0	8.1	6.1	0.0	0.0	30.7	24.2	9.7	0.0
Public support	27.4	50.7	10.9	0.0	18.4	10.2	0.0	0.0	33.8	66.1	20.9	0.0
n =		73				49				62		

Source: SMEPOL-survey

Finally, it is interesting to observe that a significant number of test-SMEs did not indicate important relations either to regional technology centres or national support programmes. In fact, they are either located in technology centres or receive innovation support by national programmes (which is the reason for belonging to the test sample), but, obviously, they often do not see them as cooperation partners in the innovation process. Communication seems to be often restricted to what is necessary to receive funding. But the firms do not or cannot (because there is no adequate information) use the further knowledge of these institutions about innovations, contacts, markets, etc.

Concentrating on the cooperations which are important for SMEs besides the usually quite strong customer-supplier relations, we will look at certain groups of SMEs now in more detail:

Table III.20: Important cooperation partners by types of SMEs (valid % of firms)

Partners in the region	*Service firms*	*Universities*	*Research org.*	*Tech. centres*	*Training inst.*	*Publ. support*
Employees:						
1 - 9	18.6	2.3	2.3	11.6	7.0	7.0
10 - 49	11.1	5.6	5.6	0.0	8.3	2.8
50 - 249	10.5	5.3	2.6	0.0	2.6	7.9
Industry:						
Wood / furniture	13.3	0.0	0.0	0.0	6.7	6.7
Plastic products	0.0	0.0	0.0	0.0	0.0	0.0
Metal (products)	5.9	0.0	0.0	0.0	5.9	5.9
Machinery	4.8	0.0	4.8	4.8	9.5	4.8
Electro(nics)	11.1	11.1	0.0	11.1	0.0	0.0
Producer services	25.0	5.6	5.6	8.3	5.6	8.3
Partners in Austria						
Employees:						
1 - 9	2.3	7.0	7.0	0.0	4.7	14.0
10 - 49	2.8	8.3	8.3	2.8	2.8	19.4
50 - 249	10.5	2.6	0.0	0.0	0.0	18.4
Industry:						
Wood / furniture	0.0	0.0	0.0	0.0	0.0	6.7
Plastic products	0.0	0.0	11.1	0.0	0.0	11.1
Metal (products)	11.8	5.9	5.9	0.0	0.0	29.4
Machinery	0.0	9.5	4.8	4.8	0.0	9.5
Electro(nics)	0.0	22.2	0.0	0.0	0.0	11.1
Producer services	5.6	2.8	5.6	0.0	5.6	22.2

Source: SMEPOL-survey

Cooperation with service firms tends to be regional. The smaller the firm the higher the frequency of such collaborations. Regarding industry differences, regional service firms are most important for producer services (i.e., cooperation within the service sector), wood/furniture and electro/electronics. Service firms outside the region are only used to some extent by the larger SMEs and manufacturers of metal products. Knowledge providers are rarely used partners on both spatial levels. Only very few industries have relations with universities or research organizations,

the only exception being electro(nics). Technology centres and training institutions act as cooperation partners primarily within the region. Regional technology centres are hardly used by SMEs others than those of the smallest size and of the electro(nics)-industry. The dominance of national support instruments applies more or less to all size-classes and industries.

If the SMEs are differentiated by innovativeness, we see that with respect to universities, research organizations, training institutions, and public support the more innovative firms have generally more cooperations both at the regional and national level. This shows, in line with other evidence, that innovating firms are better networkers within the region and beyond. Concerning service firms the pattern is less clear; both innovative and less innovative firms interact with them, in particular at the regional level.

Table III.21: Important cooperation partners by type of innovator (valid % of SMEs)

Partners in the region	*Service firms*	*Universities*	*Research org.*	*Tech. centres*	*Training inst.*	*Publ. support*
Products new to market	11.5	4.9	6.6	6.6	8.2	4.9
Products modified or new for firm only	12.0	4.0	0.0	2.0	2.0	6.0
Newly developed technologies	14.7	8.8	8.8	2.9	8.8	11.8
Adopted technologies only	14.7	2.9	2.9	2.9	2.9	2.9
Share of innovative products above avrg.*	11.1	2.8	8.3	8.3	8.3	8.3
Share of innovative products below avrg.*	14.3	4.3	1.4	2.9	4.3	2.9
Partners in Austria						
Products new to market	4.9	9.8	9.8	0.0	1.6	16.4
Products modified or new for firm only	4.0	4.0	2.0	2.0	2.0	16.0
Newly developed technologies	8.8	14.7	17.6	0.0	2.9	23.5
Adopted technologies only	2.9	5.9	2.9	2.9	0.0	11.8
Share of innovative products above avrg.*	2.8	11.1	13.9	0.0	5.6	30.6
Share of innovative products below avrg.*	5.7	5.7	2.9	1.4	0.0	8.6

* Average share of innovative products in the case of SMEs: 33.9%

Source: SMEPOL-survey

The primary way to get into contact with innovation partners is unambiguously direct without the use of mediators. All samples have a percentage of around 97% of direct contacts. Considering this

clear priority, SMEs of the test sample are the most active users of mediators (12%). This applies to 7% of the SMEs of the control sample and only 5% of the other firms.

Table III.22: Reasons for not cooperating in the innovation process (valid % of firms)

	SME-test	*SME-control*	*No SME*
No need	54.0	53.3	44.7
Too costly	34.0	40.0	28.9
No adequate partners nearby	40.0	36.7	57.9
Contacted partners not interested	16.0	20.0	26.3

Several reasons in the same firm possible.

Source: SMEPOL-survey

Why do firms prefer not to cooperate with certain innovation partners? Interpreting table III.22 it has to be considered that not only those firms which are not cooperating at all could answer to this question, but also those which have no relations to certain partners but cooperate with others. As far as SMEs are concerned, the most important reason is simply that they think that they do not need a partner. In particular for the SMEs of the control sample cooperation seems also to be too costly to be an attractive solution. The pattern is different for the large or dependent firms which mentioned the lack of adequate partners first. Obviously the higher degree of specialization makes it more difficult for them to find adequate partners in the region. As far as the potential intensification of cooperating in the future is concerned, it is interesting to observe that only few firms are confronted with a lack of interest by the contacted partner.

Table III.23: Reasons for not cooperating in the innovation process by type of SME (valid % of firms)

	No need	*Too costly*	*No adequate partners nearby*	*Contacted partners not interested*
Employees:				
1 - 9	64.5	32.3	35.5	16.1
10 - 49	36.0	48.0	44.0	16.0
50 - 249	54.5	31.8	40.9	18.2
Industry:				
Wood / furniture	60.0	20.0	40.0	20.0
Plastic products	0.0	33.3	33.3	33.3
Metal (products)	40.0	40.0	60.0	10.0
Machinery	50.0	50.0	50.0	16.7
Electro(nics)	60.0	0.0	20.0	20.0
Producer services	27.6	44.8	34.5	17.2

Source: SMEPOL-survey

Looking at different types of SMEs (table III.23) we can see that for the smallest firms (1-9 employees) “no need” is the dominating reason not to cooperate. In this segment the lack of

awareness of potential benefits of cooperations seems to be particularly high. For the firms from 10 to 50 employees the cost aspects are dominating, together with the lack of adequate partners in the region.

Differentiating by type of innovator (table III.24) we find a specific pattern for those firms which have developed new technologies: 2/3 of them see a need to cooperate and for 4/5 the respective cost are acceptable. However, for about half of the innovative firms there is the problem that adequate partners cannot be found nearby.

Table III.24: Reasons for not cooperating by type of innovator (valid % of SMEs)

	No need	*Too costly*	*No adequate partners nearby*	*Contacted partners not interested*
Products new to market	53.6	39.6	46.6	18.7
Products modified or new for firm only	51.8	37.0	33.3	18.5
Newly developed technologies	35.0	20.0	50.0	25.0
Adopted technologies only	52.1	43.4	34.8	8.7
Share of innovative products above avrg.*	52.0	39.0	56.4	17.3
Share of innovative products below avrg.*	54.9	35.8	35.8	21.5

* Average share of innovative products in the case of SMEs: 33.9%

Source: SMEPOL-survey

5 The use of innovation support instruments

Reflecting the innovation support system in Austria, direct support for innovation projects through the provision of grants and loans is the by far most frequently used instrument (see table III.25). Most of the SMEs which did not receive support by the instruments investigated in this study do not use other support programmes or institutions either. (In fact, their number is limited, most of the important programmes are covered by our analysis). SMEs of the test sample are more focussing on direct support than the large/dependent firms. On the contrary, they use the services of technology centres less, and they have also less venture capital participations. In general, risk capital appears mainly in the form of direct private investments. The role of venture capital funds is negligible, only one firm which belongs to the test sample mentioned this kind of risk finance (provided by an Austrian fund).

Table III.25: Use of support instruments (% of firms)

	SME-test	*SME-control*	*No SME*
Direct support (grants and/or loans)	89.7	6.5	82.8
Services of technology centres	34.6	0.0	37.5
Venture capital	6.4	1.6	9.4

Source: SMEPOL-survey

The data lead to two striking results: First, technology centres are not frequently used by external SMEs. As far as the test-SMEs are concerned, more than half of those who are using services from technology centres are also located there (13 firms). Only 9 test-SMEs with relations to technology centres are external companies. Services provided by technology centres are obviously more important (or better accessible) for firms which are not SMEs. In this group 3 firms are located in technology centres, but 22 external companies use their services. The rather low acceptance of technology centres is not restricted to the centres in Upper Austria. According to the results of the survey, SMEs which do not use services of regional technology centres also do not have relations with centres outside. Second, venture capital funds are hardly used by Upper Austrian firms. This is not surprising considering the low role of venture capital in Austria in general. Two potentially important instruments, thus, obviously do not reach their target groups sufficiently!

Table III.26 shows that the support instruments are more or less frequently used depending on the type of SME.

Table III.26: Use of support instruments by type of SME (% of firms)

	Direct support	*Technology centres*	*Venture capital*
Employees:			
1 - 9	43.6	21.8	5.5
10 - 49	57.5	12.5	2.5
50 - 249	62.5	17.5	5.0
Industry:			
Wood / furniture	43.8	0.0	0.0
Plastic products	77.8	11.1	0.0
Metal (products)	83.3	22.2	0.0
Machinery	52.2	17.4	4.3
Electro(nics)	50.0	10.0	10.0
Producer services	43.8	27.1	6.3

Source: SMEPOL-survey

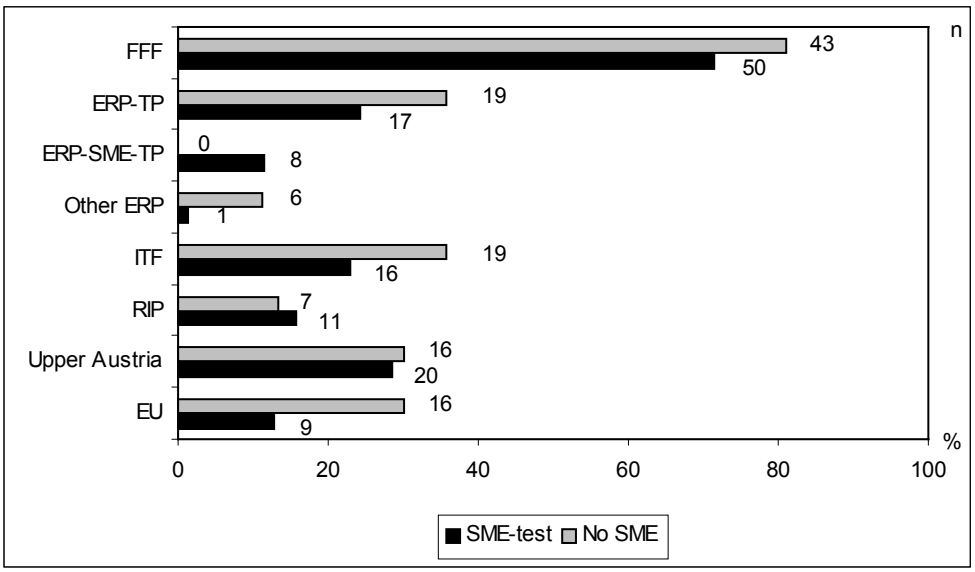
The use of direct support instruments increases with size. Referring to industry, direct support is most frequent in the case of manufacturers of metal and plastic products and least frequent in the case of wood and furniture as well as producer services. Technology centres are most often used by the smallest SMEs. On the contrary, only few firms between 10 and 49 employees have support

relations with technology centres. The industries which have most often relations with technology centres are services and metal products. According to our survey, there are no relations with the wood/furniture-sector. This sector might hardly need technology support, because it is not confronted with rapid technological development. External risk capital is most frequent in the electro(nics)-industry; but even there, not more than 10% of the SMEs have such a form of innovation financing.

Most SMEs having received support so far seem to be quite satisfied with the benefits, because most of them plan to apply for support in the future again (90%, only 10% deny this). This share is even higher in the case of firms which are not SMEs where 95% agree to do that. The SMEs of the control sample are clearly less willing to look for support, only one half plans to apply. This points to a cumulative nature and a learning aspect of these links. Once firms have learned to use the specific support instruments, they find it easier to take advantage of them in the future too.

Which specific programmes and institutions of direct support have been used by the investigated firms?

Figure III.7: Direct support programmes used by the respondents (numbers: participating firms, bars: valid % of firms)



Source: SMEPOL-survey

The FFF-programme has been obviously used most frequently. Partly this is due to the fact that we have received a full list of FFF-beneficiaries, whereas in the case of the ERP, due to reservations regarding data protection, we could only get the addresses of those firms which had agreed in advance to participate in the survey. This means that the ERP-programmes, but also the programmes 'ITF' (as far as an ITF-project support is administrated by the ERP (see chapter 3.3 of part II)) and 'RIP' (which is administrated by the ERP (see chapter 3.4 of part II)), are probably more frequently used than it appears from the figure above.

About ¾ of the SMEs of the test sample are supported by the FFF, followed by the general technology programme of the ERP. The special SME-Technology programme of this institution is

less frequently used. Support by programmes of the province of Upper Austria is also quite frequent, actually more frequent than ITF- or RIP-support. The large number of firms having received regional support, however, is partly caused by the fact that the data include all types of subsidies provided by Upper Austria for firms in the region, not only those aiming primarily at innovation. Further, regional subsidies are small compared with national support programmes (see chapter 2.1 of part II) and are, therefore, additional in their character. The case of large or dependent firms is similar, but the percentages are higher (except RIP and the ERP-SME programme which is inaccessible for large firms).

The following table shows the frequency of the responding firms located in and using services from technology centres:

Table III.27: Use of technology centres* by responding firms

	Located in technology centres		*Using services of technology centres*	
	n	*in %*	*n*	*in %*
GTZ (Wels)	6	37.5	0	0.0
FAZAT (Steyr)	3	18.8	3	9.7
SWP (Hagenberg)	2	12.5	1	3.2
TZ-I (Braunau))	2	12.5	6	19.4
TZ-L (Linz)	2	12.5	9	29.0
TZ-S (Lenzing)	1	6.3	0	0.0
Centres in Upper Austria, not specified			6	19.4
Centres in Austria			10	32.3
International centres			1	3.2
Total number of users:	16	100	31	100

* In brackets location of the Upper Austrian technology centres, described in detail in chapters II 2.2.1 and 2.2.2.

As far as services of technology centres are concerned several institutions could be mentioned.

Source: SMEPOL-survey

Most firms are located in the facility-oriented technology centres (GTZ, TZ-I, TZ-L, TZ-S). Only five of the respondents are located in the two R&D-oriented technology centres which is not surprising, because the FAZAT and the SWP are comparatively small. For the description of these technology centres see chapters 2.2.1 and 2.2.2 of part II.

As far as the use of services of the Upper Austrian and other technology centres is concerned, two facility-oriented centres (TZ-L, TZ-I) were mentioned most frequently. The R&D-oriented centres are less frequently contacted, probably because of the more specialized type of activities and fields of technologies in these institutions (see chapter II 2.2.1). The intensity of external relations of the Upper Austrian technology centres should not be assessed too strictly based on our results. First, the number of respondents is rather low; second, some firms indicated relations to Upper Austrian technology centres in general without specifying the institution. Proximity seems to matter, since centres within the province are more important for Upper Austrian firms than centres in other parts of Austria: 25 firms indicated relations with centres in Upper Austria, 6 exclusively with centres in

other provinces of Austria. Most of the services of technology centres which are used by the responding firms are to be characterized as consulting, often about funding opportunities for innovation and R&D-projects. There are rather few cases of technical services like testing, CAD, or similar services.

As mentioned above, the general level of satisfaction with the support instruments seems to be quite high. This can be concluded from the high share of firms which plan to apply (again) for support. But how is the assessment of certain aspects of the administration of the support programmes? We have asked the respondents to tell us to what extent they are satisfied regarding the provision of information, consulting services, the speed of the administrative process, the complexity of bureaucratic procedures (requirements), the accessibility, and the reliability of the institutions from which they have received support. Due to the fact that many firms are supported by different instruments at the same time, it is not possible to present instrument-specific data for all of them. The only exception is the FFF-programme; in this case there are enough respondents exclusively participating in this programme (see also III 6). Therefore, the next table shows the level of satisfaction of SMEs having received support by a certain type of instrument, not a particular programme.

Table III.28: Assessment of the administration of the support instruments (valid % of SMEs)

			SMEs receiving support from			
		All test-SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Information	positive	69.6	60.0	72.7	69.6	75.0
	indifferent	21.7	13.3	21.2	21.7	8.3
	negative	8.7	26.7	6.1	8.7	16.7
Consultancy	positive	65.7	73.3	67.2	47.6	83.3
	indifferent	26.9	20.0	25.0	38.1	8.3
	negative	7.5	6.7	7.8	14.3	8.3
Speed	positive	58.0	66.7	57.6	45.8	75.0
	indifferent	33.3	20.0	33.3	50.0	16.7
	negative	8.7	13.3	9.1	4.2	8.3
Bureaucracy	positive	35.8	40.0	34.4	26.1	41.7
	indifferent	35.8	40.0	35.9	39.1	41.7
	negative	28.4	20.0	29.7	34.8	16.7
Accessibility	positive	60.3	66.7	60.0	38.1	75.0
	indifferent	30.2	13.3	30.0	52.4	0.0
	negative	9.5	20.0	10.0	9.5	25.0
Reliability	positive	71.9	80.0	73.3	61.9	91.7
	indifferent	21.9	13.3	20.0	28.6	0.0
	negative	6.3	6.7	6.7	9.5	8.3

Source: SMEPOL-survey

In general, the level of satisfaction is indeed high. For most aspects of assessment, the majority gave a positive answer. The only general negative exception refers to the bureaucracy of the

administrative procedures. The best assessment concerns the reliability of the support institutions. The rather high degree of satisfaction with direct support does not apply to all programmes equally. The judgement (except for information) of the FFF is worse in comparison. In this context, it has to be mentioned that the FFF (and also the ITF) is more research-oriented requiring more sophisticated project documentations. This probably explains the worse assessment to some extent. Compared to the direct support programmes, the technology centres show some weaknesses, especially concerning the provision of information. Regarding the aspects 'bureaucracy', 'accessibility' (mentioned primarily by external firms using services of technology centres), and the 'speed of administrative procedures' the evaluation of technology centres is more polarized. A clear majority of firms evaluates them positively, but up to 1/5 of firms expresses also dissatisfaction.

Before analyzing the effects of the support instruments on the innovation process of SMEs, we will present the reasons why certain firms have not applied for support:

Table III.29: Reasons for not having received innovation support

	SME-control	*No SME*
Number of firms without support:	58	5
in % of the sample:	93.5	7.8
Reasons mentioned by firms without support (in %):		
No need	33.3	40.0
Application/project documentation too costly	40.0	20.0
Lack of information	64.4	60.0
Required level of project quality could not be met	4.4	0.0
Inadequate criteria/focus areas of support	15.6	40.0

Several reasons in the same firm are possible.

Source: SMEPOL-survey

As to be expected, a very high share of SMEs of the control sample have not received any form of innovation support. Only 4 SMEs of this sample were supported by other than the investigated instruments. Among the reason indicated for not having received support most frequently stated is the lack of information regarding support opportunities (64% of firms). This is clearly the most important barrier. Second is the problem of costly application procedures and project documentation (40%). Another third of the firms is convinced not to need support. Less often mentioned were inadequate selection criteria or focus areas and the required quality standards for innovation projects. As far as large or dependent firms are concerned, there are only very few firms without innovation support. The claimed reasons (predomiantly a lack of information), therefore, have no general importance for firms belonging to this group.

The differentiation by type of SME is shown in the next table (III.30). Industries with a very small number of responses have been omitted:

Table III.30: Reasons for not having received support by type of SME (valid % of firms)

	No need	*Too costly/ complicated*	*Lack of information*	*Too high quality level*	*Inadequate criteria*
Employees:					
1 - 9	40.0	35.0	65.0	10.0	15.0
10 - 49	30.8	61.5	61.5	0.0	23.1
50 - 249	30.0	30.0	80.0	0.0	10.0
Industry:					
Wood / furniture	14.3	42.9	71.4	0.0	14.3
Machinery	11.1	33.3	66.7	0.0	22.2
Producer services	43.8	37.5	75.0	12.5	12.5

Source: SMEPOL-survey

The following differences can be seen: "No need for support" is claimed most often by the smallest SMEs. High costs of application and project documentation is most important in firms between 10 and 49 employees and a lack of information is most frequently claimed by the larger SMEs. This pattern is quite similar to the cooperation barriers analyzed above where we also found a presumable lack of need for cooperations for the smallest firms whereas the group between 10 and 49 employees was particularly sensitive to the cost of cooperations. Interestingly, the larger SMEs are aware of the benefits of external support but feel that they are lacking the relevant information.

Concerning the industry differences, we can observe that in particular producer services argue to have less need for support (this could be due to lower capital- and/or technology-requirements for innovation), and unexpectedly, also a lack of information. For firms in the wood and furniture industry, on the other hand, the procedure seems often to be too costly or complicated to make use of innovation support.

As far as SMEs are concerned which have not introduced any innovations (products or processes) at all, the most frequent reason was "no need" (57% of the responding firms), followed by a lack of information (43%). Too high expenditures for project application or documentation were a barrier for 14% of companies.

6 Effects of the selected support instruments on the innovation process of the participating SMEs

In this chapter we will analyze the effects of the investigated innovation support instruments on the SMEs, i.e., the SMEs belonging to the test sample. It is tempting to analyze the results for each instrument. Unfortunately, this is not possible due to the fact that most subsets of SMEs benefiting from a specific instrument are too small for a statistical analysis (see table III.31). A further problem results from the fact that many firms are benefiting from more than one instrument. As a consequence, the effects are overlapping and cannot be unambiguously separated. Restricting the analysis to those SMEs which benefit exclusively from one instrument would reduce the already small number of firms of this instrument. This means that we had to analyze aggregated sets of

firms belonging to the following general types of support instruments: First, technology centres - comprising SMEs located there as well as external SMEs using the centres' services. Second, direct support programmes - consisting of SMEs participating in any of the investigated programmes. In addition, we have analyzed two subsets of SMEs: Participants of the direct support programme 'FFF' (without receiving any other support) and the set of SMEs which benefit from technology centres as well as direct support programmes. How many SMEs benefit from a certain support instrument or type of instrument is presented in the next table (III.31):

Table III.31: Participation of SMEs in the investigated support instruments

Innovation support instrument	*Number of SMEs*
Total number of participants incl. multiple participants:	
All instruments	78
SMEs located in Upper Austrian technology centres	13
SMEs using the services of Upper Austrian technology centres *	9
FFF	50
ERP-Technology programme	17
ERP-SME-Technology programme	8
ITF	16
RIP	11
Number of participants of types of support instruments:	
SMEs located in and using the services of Upper Austrian technology centres	22
SMEs participating in the investigated direct support programmes	67
SMEs participating exclusively in the FFF-programme	24
SMEs benefiting from technology centres as well as from direct support programmes	12

* Without being located in a regional technology centre.

For interpreting the survey results regarding the effects of support instruments, the following facts have to be considered: Most sets of SMEs are not mutually exclusive. The effects are, therefore, overlapping. The only exclusive sets are SMEs participating in the FFF-programme only and SMEs benefiting from technology centres as well as direct support. The types of instruments - technology centres and direct support programmes - consist of quite different specific centres and programmes. Interpreting their effects needs additional information about their specific characteristics and activities (described in detail in part II; technology centres in chapters 2.2.1 and 2.2.2; direct support programmes in chapters 3.1 to 3.4).

Before we are going to analyze the effects of the support instruments, it is reasonable to present the structure of the respective firms regarding size and industry (table III.32):

Table III.32: Employment and industries of the test-SMEs (valid % of firms)

	All SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
n =	140	22	67	24	12
Employees:					
1 - 9	40.7	65.0	30.8	37.5	45.5
10 - 49	29.6	20.0	35.4	50.0	36.4
50 - 249	29.6	15.0	33.8	12.5	18.2
Industries:					
Wood prd., furniture, toys, etc.[1]	11.5	0.0	7.5	4.2	0.0
Plastic products	6.5	0.0	10.6	20.8	0.0
Metal and metal products	13.0	13.6	21.2	16.7	16.7
Machinery	16.5	13.6	18.2	25.0	16.7
Electrical equipment, MMSO[2]	7.2	9.0	7.5	8.3	16.6
Engineering, data processing	34.5	54.5	25.8	20.8	41.7

[1] Includes also sports equiment and musical instruments.

[2] Medical, measurement, systems, and optical technologies.

Source: SMEPOL-survey

Regarding the number of employees, the table shows that firms located in or using services of technology centres are predominantly small (less than 10 employees). In the case of SMEs which participate in direct support programmes, the distribution is more equal. But, as the example of the FFF shows, this can vary between programmes. Especially the programmes of the ERP (including the RIP) seem to reach more the larger SMEs.

Regarding industry differences, service companies are the most frequent users of technology centres. Only few firms which are located in such centres are not service firms. As far as external firms are concerned, customers of technology centres are often firms of the machinery and metal products industries. The same industries are also important participants in the FFF-programme, but there the industrial composition is more diverse (comprising also plastics and producer services). All ERP-programmes (incl. RIP) tend to focus more on metal and metal products. Except for the SME-programme, service firms seem to be of little importance in the direct support schemes.

The following table (III.33) summarizes the direct effects of the support instruments on the innovation process or certain innovation projects of the SMEs:

Table III.33: Direct effects of the support instruments (% of SMEs, strong effects only)

		SMEs receiving support from			
	All test-SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
n =	78	22	67	24	12
Effects of direct support:					
Funding of investments	59.0	–	65.7	45.8	91.7
Funding of personnel	43.6	–	50.7	54.2	58.3
Funding of consultancy	28.2	–	31.3	33.3	16.7
Taking over of risk	23.1	–	25.4	25.0	33.3
Effects of technology centres:					
Provision of technical know-how	5.1	18.2	–	–	25.0
Technical services	3.8	9.1	–	–	16.7
Provision of infrastructure	1.3	4.5	–	–	0.0
Effects from both instruments:					
Initiation of cooperations with firms	7.7	9.1	9.0	0.0	16.7
Initiation of cooperations with science	7.7	9.1	9.0	4.2	16.7
Provision of market information	6.4	0.0	7.5	8.3	0.0
Support for commercialization	6.4	0.0	7.5	12.5	0.0

Shaded: SME-subsets with a frequency > all SMEs of the test sample.

Source: SMEPOL-survey

The most important direct effects are, in general, support for the financing of investments (first) and personnel (second). The support for investments is the only effect which was mentioned by more than the half of the SMEs having a strong impact on their innovation activities. Clearly less frequent, but still mentioned by more than 20% of the firms are the funding of external consulting services and the reduction of the risk of failure of a certain innovation project. The other effects were mentioned rarely. In this context it has to be considered that some effects can only be induced by a specific instrument. Such instrument-specific effects are in the case of technology centres 'provision of technical know-how', 'technical services' and 'provision of infrastructure' and in the case of direct support 'funding of investments/personnel/consultancy' and 'taking over of risk'. Due to the smaller number of SMEs benefiting from technology centres, the frequency of their specific effects in the whole test sample is low. Nevertheless, the specific effects of technology centres are also rarely found in the set of SMEs using their services or being located there. In general, firms find it hard to name the specific contribution of technology centres to innovation. This seems to apply more for firms located there than for external firms which use their services, especially regarding the provision of technical know-how.

Further effects which can result potentially from both types of instruments are very rare too. Obviously, they are weak, because the support instruments do not sufficiently target them. This applies most of all to market-oriented support like the provision of market information and the support for the commercialization of innovations. In the case of technology centres such effects were not indicated at all. Further deficits seem to be the stimulation of cooperations, both with other firms and research institutions.

According to the data, direct support programmes seem to be more effective in supporting the innovation process of SMEs than technology centres. Of course, the primary effect is funding (especially investments followed by personnel). The stimulation of cooperations, the provision of market information, and the support for the commercialization of innovations play a minor role. As mentioned already above (see the first paragraph of this chapter III 6), differences between certain direct support programmes are difficult to analyze, because few firms use specific instruments exclusively. But it seems to be that ERP-programmes (including the RIP) are more effective in funding investments (especially the SME-programme and the RIP), whereas the effects of the FFF and the ITF are more focussed on the funding of personnel. In addition, the ERP-SME-Technology programme seems to be more effective than the other programmes in initiating cooperations with other firms. It is interesting to observe that most effects are strongest in the case of firms having received combined support by technology centres and funding programmes.

Beyond the direct effects on the innovation process, there might be further indirect effects within the same firm:

Table III.34: Further internal effects (% of SMEs)

		SMEs receiving support from			
	All test-SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Increase in productivity:					
a) Labour	53.8	40.9	58.2	41.7	58.3
b) Capital	29.4	31.8	32.8	29.2	50.0
New opportunities of development:					
a) Internationalization	34.6	31.7	38.9	41.7	50.0
b) Diversification into new markets	39.7	27.2	44.8	41.7	41.7
c) Expansion in the same market	56.4	50.0	61.2	45.9	75.0
Creation of new jobs:	64.1	45.5	71.6	62.5	66.7
Initiation of a continuous or intensified innovation process:	48.7	45.5	53.7	41.7	66.7

In the cases of productivity and development opportunities more than one type could be mentioned.

Shaded: SME-subsets with a frequency > all SMEs of the test sample.

Source: SMEPOL-survey

The effects listed in the table above result indirectly from innovation support instruments. They comprise two types: First, longer-term positive effects on the innovation process, emerging after the end of a specific project support or outlasting it. This applies to the items ‘continuous or intensified innovation process’ and, partially, ‘new development opportunities’ (especially ‘diversification into new markets’). Second, effects other than innovation-related ones. They are not the (primary)

targets of the support schemes, but often might be an important additional benefit. This applies to ‘productivity increase’ and ‘creation of new jobs’.

In more than the half of the SMEs, the supported innovation projects or activities have led to a rising labour productivity. An increase in capital productivity is less frequent. Labour productivity is more likely to be improved by direct support instruments, but to a varying degree. It is less in the cases of the FFF and the ERP-Technology programme, more in the cases of the ERP-SME-Technology programme, the RIP, and the ITF. The latter programmes support more the introduction of labour-saving technologies. Increasing capital productivity is most frequent in the case of SMEs supported by technology centres as well as direct support programmes. Between the other sets there are hardly differences. As far as technology centres are concerned, however, the latter effect is more frequent when they act as providers of support for external SMEs.

New opportunities for the development of the SME concentrate on the expansion within the same market. This applies to all types of instruments. Internationalization and the diversification into new markets is more frequent in the case of firms participating in direct support programmes than in firms located in or using services of technology centres. This may be due to the larger size of involved companies. A positive effect on internationalization seems to be a specific advantage of the ERP-SME-Technology programme. As a contrast the expansion within the same market is more typical for other ERP-programmes (incl. RIP).

The creation of new jobs is obviously favoured by most support instruments, but it was less frequently indicated by firms located in technology centres and benefiting from the ERP-SME-Technology programme. For technology centres this contrasts with a rather strong job increase of supported firms (see table III.38). Obviously, growth is a general characteristic of related firms but has not been directly attributed to the specific support of these centres.

Nearly half of the respondents claimed that the support initiated a continuous or intensified innovation process beyond the supported project. At first glance this looks good. Nevertheless, it implies that the other half of the firms did not proceed to innovate, but, obviously, still regard innovation as occasional. The stimulation of a continuous innovation process is most frequent in the case of SMEs using services of technology centres (but not those which are located there) and participants of the ITF-programme.

Besides the internal effects of innovation support instruments there are also external effects on other firms which are of interest. We asked for cooperations, spin-offs or start-ups (classified as ‘external’, because of the emergence of a new organizational entity), and spillover effects (see table III.35).

Table III.35: External effects of the support instruments (% of SMEs)

		SMEs receiving support from			
	All test-SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Continuous cooperations with:					
a) other firms	42.3	45.5	47.8	29.2	83.3
b) research institutions	15.4	22.7	18.0	12.5	41.6
Cause for firm's start-up or spin-off	14.1	18.2	14.9	12.5	25.0
Spillover effects to other firms	64.1	59.1	70.1	54.2	83.3
Spatial scope of spillover effects:					
a) Upper Austria	46.2	50.0	49.2	33.3	66.7
b) outside the province	52.6	45.5	56.7	41.7	58.4
Firms benefiting from spillovers:					
x) customers	44.8	40.8	49.3	33.4	58.3
y) suppliers	35.8	22.7	40.3	45.8	33.3
z) other firms	12.7	13.6	13.5	12.5	16.7

In the cases of cooperations and spillovers more than one type could be mentioned.

Shaded: SME-subsets with a frequency > all SMEs of the test sample.

Source: SMEPOL-survey

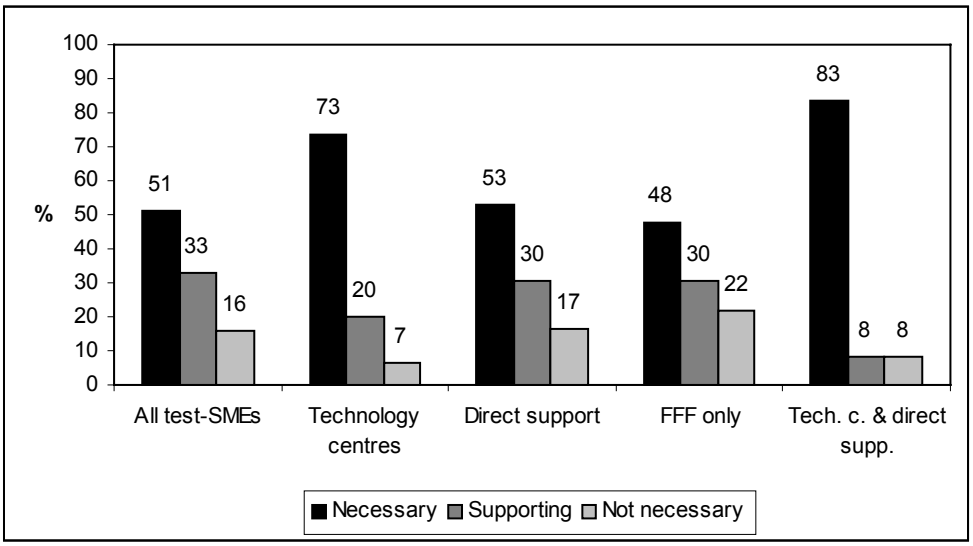
Cooperations with other firms are a rather frequent consequence of innovation support, most frequent in the case of firms using services of technology centres and some, but not all, direct support programmes, especially the ERP-SME-Technology programme and the RIP. It is interesting that the initiation of cooperations was less frequently mentioned (see the internal effects, table III.33). Obviously, many firms had already established relations before they received innovation support, but the support led to an intensification of these relations (see also the frequency of external relations of firms in the innovation process, table III.19). Referring to the types of partners, continuous cooperations with research institutions are less frequent than with other firms.

Firms which have been founded at least partly due to the support for an innovation project are generally rare. It is comparatively more frequent in the case of SMEs located in technology centres which act often as incubation centres (see chapter 2.2 of part II) and the ERP-SME-Technology programme.

Positive effects on other firms - most often in the form of improved products or services - were frequently claimed. In the case of firms supported by technology centres, the effects seem to be more regional and customer-oriented. In the case of participants in direct support programmes, the effects are more national and more often benefiting suppliers too (more in the cases of the FFF and the ITF, less in the cases of the ERP-programmes and the RIP). Effects on other firms outside customer-supplier-relations are generally rare.

Finally, the firms were asked to assess the necessity of the respective support they have received by certain instruments for their innovation activities in general or the realization of specific innovation projects. The respondents could choose between 'necessary', meaning that the respective innovation project or activity could not have been finished without the support, 'supporting', meaning that the support made it possible to conduct the innovation project faster or at a larger scale, or 'not necessary', meaning that the innovation would have been introduced in any case. Of course, even in the latter case the support might have had a significant positive impact (e.g., lower costs making funds available for other purposes).

Figure III.8: The necessity of the support instruments for the realization of the innovation projects (valid % of SMEs)



Source: SMEPOL-survey

From the figure above follows that the necessity of support for certain innovation projects was most often indicated in the case of technology centres. There seems to be no difference between SMEs located in or external firms using services from technology centres. That support was necessary is the most frequent answer of the respondents of all types of innovation support. The frequency, however, is clearly lower in the case of direct support. This shows that the efficiency of direct support programmes regarding the stimulation of innovation might be rather low. It is obviously necessary to aim more strictly at certain types of SMEs which really need support to start, improve, or maintain an innovation process. That direct support can have a substantial impact on innovation might be assumed, if one considers the high degree of necessity in the case of the combined innovation support.

7 The influence of the support instruments on innovativeness and performance

In this final chapter of part III, we will deal with the question how innovative the SMEs supported by the investigated instruments are, what their performance looks like, and if differences between them and SMEs which have not received support can be assumed. Of course, differences in innovativeness cannot be assigned to the support instruments exclusively. Therefore, innovation support should be interpreted as one likely positive cause for the observed differences only.

As far as product innovations are concerned, all instruments seem to have a positive impact (see table III.36). Firms having introduced any type of product innovation are close or even equal to 100%. Comparatively least frequent are product innovations in the case of SMEs supported by technology centres, especially when they are located in such centres. It has to be considered, however, that not all of them share the same characteristics (see chapter 2.2 of part II). Facility-oriented technology centres are obviously used by a number of start-ups which offer products or services already available elsewhere. Nevertheless, the frequency of product innovation in the case of these firms is still high. Additionally, it might be that some firms started their business with an innovative product or service and are currently trying to expand their market share, but, at this time, do not think of new innovations.

Table III.36: Innovations within the last three years (SMEs only)

		SMEs receiving support from			
	All SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Product innovations (% of firms):	82.9	86.4	95.5	91.7	100.0
Frequency (in %) of innovators with					
a) modifications	62.3	47.3	57.1	54.5	50.0
b) products new for the firm	71.1	63.2	77.8	68.2	66.6
c) products new to the market	55.3	63.2	66.6	68.2	75.0
Process innovations (% of firms):	49.3	50.0	61.2	58.3	66.7
Frequency (in %) of innovators					
a) having adopted existing tech.	72.1	90.9	63.5	35.7	87.5
b) having developed new tech.	50.0	36.4	58.6	85.7	37.5
Frequency (in %) of those aiming at					
a) improving productivity	63.3	72.8	58.6	42.6	62.5
b) flexibilization of production	38.3	27.3	39.0	28.4	37.5
c) improving quality	66.2	45.5	63.5	57.0	50.0
d) technological basis for new products	54.6	63.7	68.3	71.3	62.5

Shaded: SME-subsets with a frequency > SMEs in general.

Source: SMEPOL-survey

The highest rate of more far-reaching innovations (those which are new to the market) can be found in the case of the direct support programmes. However, there are differences. The weakest innovators of this category seem to be those participating in the ERP-Technology programme. The most successful SMEs, on the contrary, are obviously those which have used both types of innovation support instruments - direct support and services of technology centres. This confirms the impression from the effects of support instruments on the innovation process of SMEs (see chapter III 6, table III.33) that the combination of instruments is more effective than the isolated provision of support.

Process innovations are generally less frequent than product innovations. Inducing process innovations is obviously not the strongest effect of these instruments, relative more frequent in the case of the RIP-programme. Further, there are differences regarding the degree of innovativeness: In the case of firms supported by technology centres, most process innovations are adoptions of existing technologies (possibly in part due to the transfer function of these centres). Newly developed technologies are more frequent in the case of SMEs supported directly. This applies especially to the FFF, but also the Technology programme of the ERP.

Interpreting the pattern of objectives of process innovations, we find that raising productivity is the primary goal of firms which are located in or using services of technology centres and of those which use direct support as well as services of technology centres. It seems to be also quite important for beneficiaries of the ERP-SME-Technology programme and the RIP. The most ambitious goal, as far as innovation is concerned, is undoubtedly to establish the technological basis for new products. This goal is most frequent in the case of firms participating in direct support programmes, especially the FFF, but also in the case of the ERP-Technology programme. All subsets of supported SMEs show a higher share of the motive 'technological basis for new products' than SMEs in general. Quality improvement is not a top priority; nevertheless, in the case of direct support it ranks second. Comparatively of least importance seems to be the goal of making production more flexible. This objective is related to an already longer lasting process and was the focus of older programs (C-technologies). It is no longer a primary target of technology support.

Table III.37 shows differences between the instruments as far as the firms' inputs into the innovation process are concerned. For both types of inputs into the innovation process - financial resources and manpower - the highest average values in relative terms (in % of sales and total employment) can be found in the case of firms located in or using services of technology centres, exclusively or in combination with direct support. The ratios are lower in the case of direct support. This applies especially to the ERP-Technology programme and the RIP, but also, to a lesser degree, to the FFF-programme; comparatively least to the ERP-SME-Technology programme. This can be explained by the fact that SMEs supported by technology centres are smaller than those participating in direct support programmes (see table III.32). Smaller firms tend to have higher relative innovation inputs partly due to indivisibilities (see table III.12).

The relative budgets show mostly increasing trends. The most significant result can be found in the case of firms which are using technology centres as well as direct support, and the FFF. In general, decreasing budgets are very rare. As far as staff is concerned which is primarily engaged in innovation activities, the results are very similar. The employment trend is even more important than that of the expenditures for innovation, because it is based on a real input, not a nominal one. Nevertheless, we see that growth is least frequent in the case of firms supported by technology centres. However, it has to be considered that the relative innovation manpower is already very high in these firms.

Table III.37: Inputs into the innovation process (relative innovation budgets and staff: mean values; trends: valid % of SMEs)

		SMEs receiving support from			
	All SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Average innovation budget in % of sales:	11.0	24.1	12.1	10.6	25.0
Increasing budget	54.5	63.2	64.6	72.7	75.0
Constant budget	40.5	36.8	32.3	22.7	25.0
Decreasing budget	5.0	0.0	3.1	4.5	0.0
Average innovation staff in % of employment:	15.6	38.7	16.4	14.1	36.9
Increasing staff	37.5	38.9	50.8	50.0	41.7
Constant staff	55.8	61.1	46.2	50.0	58.3
Decreasing staff	6.7	0.0	3.1	0.0	0.0

Shaded: SME-subsets with a frequency > SMEs in general.

Source: SMEPOL-survey

Finally, we will investigate, if firms supported by different instruments have different shares of innovative products in total sales, and if the respective firms are growing more or less in terms of employment and turnover than other SMEs (see table III.38). Taking the share of innovative products in total sales as an indicator for innovativeness, the most successful SMEs are those with relations to technology centres. Especially in combination with direct support, firms using services from such centres have been able to offer a quite innovative product range overall. Technology centres have an important function as incubators with a high share of young firms. Many of these firms start with innovative products or services which account for a large share of their sales. But also direct support obviously leads to a higher than the average share of innovative products. Nevertheless, within this group of instruments, there seem to be some differences. Higher shares are more likely in the case of SMEs supported by the FFF, the ERP-SME-Technology programme, and the ITF. The ERP-Technology programme and the RIP seem to be less successful in this respect. The other indicators of success - growth of employment and turnover - are both predominantly positive. Except for the FFF-supported firms, the beneficairies of all instruments are more likely to be growing than SMEs in general. But also the FFF-participants are very close to the average.

Table III.38: Performance of all SMEs and those which have received innovation support (share of innovative products: mean value; trends: valid % of firms)

		SMEs receiving support from			
	All SMEs	*Techology centres*	*Direct support*	*FFF only*	*Tech. centres & direct support*
Share of innovative products in % of total sales:	33.9	48.6	40.3	43.7	58.6
Employment trend:					
Increasing employment	48.5	72.7	63.6	47.8	83.3
Constant employment	41.2	27.3	30.3	43.5	16.7
Decreasing employment	10.3	0.0	6.1	8.7	0.0
Turnover trend:					
Increasing turnover	71.4	86.4	80.0	69.6	83.3
Constant turnover	20.3	13.6	12.3	21.7	16.7
Decreasing turnover	8.3	0.0	7.7	8.7	0.0

Shaded: SME-subsets with a frequency > SMEs in general.

Source: SMEPOL-survey

As far as the correlation between innovativeness and employment is concerned, we can additionally refer to a study (Lettmayr, 1997) which observed that innovativeness has positive effects on growth of firms, more in terms of sales than employment; and more in the case of product than process innovations. Growth is strongest in the case of combined product/process innovations. “Medium high-tech” industries have the highest growth in employment, outperforming “high-tech” firms. The most active job creators are service companies. Young firms are, in general, more expansive which underlines the importance of technology centres (in their role as incubators) in creating new jobs. Innovative firms offer more attractive jobs, because their need of higher qualified personnel is comparatively larger than in the case of less innovative firms. Nevertheless, the author comes to the conclusion that an increase of innovativeness would, in general, induce only little additional employment; it would be strongest, however, in the case of SMEs and start-ups.

In part III we have investigated innovativeness, problems constraining innovation, and effects of innovation support instruments in detail, analyzing the results of the survey to Upper Austrian firms. To which extent effects correspond to problems will be an important subject of the final part of the report (chapter IV 5).

IV

CONCLUSIONS

The final part of the report summarizes the main findings concerning the investigated innovation support instruments available for Upper Austrian SMEs and their innovation activities. Based on these results we will present our conclusions according to the research objectives of the SMEPOL-project.

1 Innovation in the SME-sector of Upper Austria

We will start the conclusions with a short summary of the key information and indicators of innovativeness of SMEs (see also table IV.1).

SMEs are quite innovative, product innovation dominates:

In general, innovations are very frequent in Upper Austrian SMEs. More than 90% of the SMEs supported by the investigated instruments (forming the 'test sample') have introduced product innovations within the last three years, slightly less than 60% process innovations. Nevertheless, large firms are still more innovative. Within the SME-sector those firms which have not received innovation support (forming the 'control sample') are clearly less innovative. In particular for SMEs product innovations are more frequent than process innovations.

SMEs which have received innovation support were able to introduce advanced product innovations more often than other firms. They have the highest frequency of products which are new to the market (and not only to the firm) and the lowest of minor modifications. Additionally, these are the firms where the innovative products have the highest share in total sales on average.

In the case of process innovations, the most active group of firms are large companies and subsidiaries. As far as SMEs are concerned, supported firms have more often developed technologies by themselves than those without support which concentrate primarily on the adoption of existing technologies in order to improve quality and productivity. The most important motives in the case of supported SMEs are an adequate technological basis for new products and the improvement of quality. Once again, this is evidence of the higher innovativeness of the SMEs of the test sample compared with those of the control sample.

The larger the SMEs, the more frequent are product and process innovators. But this does not apply to all categories of innovations. With regard to products "new to the market", there is hardly a difference, also with respect to the adoption of new technologies as a basis for new products. Technologies developed by the firms themselves, however, are rare in the case of the smallest

SMEs. In contrast to the introduction of innovations, the share of innovative products in total sales decreases with the size of firms.

SMEs of the manufacturing sector are, overall, more innovative than those of the producer service sector. On the other hand, service firms which have introduced innovations have a higher share of innovative products in total sales than many manufacturing industries.

Development is most freqent, research and market research are only rarely performed by SMEs:

Overall, the most frequent activity is 'development' (i.e., activities which are necessary to make a new product or technology ready for the market) which is actually more often performed than 'modification' (i.e., improvements of existing products). This means that many innovations are really newly developed products and not only modifications of old products. 'Research' (i.e., development of concepts or models which are several years away from their commercalization) is rather rare. It is most frequently performed in those firms which are not SMEs, in fact large companies with more than 250 employees. In a sense, they have the most "complete" innovation process. Within the SME-sector the test-sample is more active in research and development, the most research-intensive industry being electro/electronics. Market research is rarely performed by SMEs, although the test sample is doing somewhat better in this respect. Many SMEs, due to their close customer-supplier-relationships, seem to have the opinion that systematic collection of market information beyond these relations is not necessary.

In the case of SMEs the innovation staff is relatively more important than the innovation budget, for larger firms it is the opposite. In SMEs, due to the small size of the firms, a higher percentage of the employees is (most often part-time) involved in the innovation process. Confirming the results about introduced innovations, we see that the SMEs of the test sample employ more resources for the innovation process than the SMEs of the control sample. The innovation budget and personnel has been growing most strongly in the large/dependent firms within the last three years. But the SMEs of the test-sample follow quite closely, in particular with respect to expenditures. On the contrary, most of the control-SMEs show a stagnant development of innovation inputs.

Customers, suppliers, and service firms are main innovation partners, the region and the country being the most relevant interaction spaces:

In general, we find that important cooperations are rather rare for the investigated firms. Overall, their frequency is about half or less of all innovation-related contacts. The most frequent innovation partners are other companies. Customers rank first, suppliers second, services third. In the case of the SMEs, customers, service and other firms are most often located in the region, slightly less in Austria. The control sample (where firms are less innovative) is more confined to the region in this respect than the test sample. Large or dependent firms, on the contrary, are more oriented towards the European and national level, except for cooperations with service firms which are mainly regional.

Innovation partners from science are less frequent in comparison. Large firms have more collaborations with science, but also a fifth of the test-SMEs has such relations. This differs from the control-SMEs where we find no important relations at all. Due to the fact that Upper Austria does not have a technical university, universities at the national level are the most important for all subsets; for SMEs the university of Linz ranks second, while for large firms European universities are more important.

Technology centres are, in general, rarely used. If they are used, then primarily those in the region. Interestingly, large firms and subsidiaries have more relations with technology centres than the test-SMEs, whereas the control firms do not interact with these centres at all. Training institutions are more relevant innovation partners than technology centres, again primarily those located in the region.

Table IV.1: Innovation support, external relations in the innovation process, and innovative performance of the SME-sector: m = mean value, f = % of firms

		Benefiting from			*Size (empl.)*		
	All SMEs	*Tech. centr.*	*Direct supp.*	*none*	*1-9*	*10-49*	*50-249*
n	140	22	67	62	55	40	40
Benefiting from							
direct support programmes (f)	52.9	63.6	100.0	6.5	43.6	57.5	62.5
technology centres (f)	19.3	100.0	26.9	0.0	21.8	12.5	17.5
Important innovation partnerships with[1]							
customers or suppliers (f)	60.7	68.2	68.7	54.8	56.4	60.0	65.0
universities or research organizations (f)	10.0	22.7	20.9	0.0	7.3	12.5	10.0
technology centres (f)	5.7	27.3	7.5	1.6	9.1	5.0	0.0
service firms (f)	15.0	22.7	14.9	14.5	14.5	10.0	17.5
training institutions (f)	5.0	18.2	6.0	1.6	5.5	7.5	2.5
public support (f)	15.0	27.3	29.9	0.0	12.7	17.5	17.5
Introduction of advanced innovations[2] (f)	55.0	54.5	73.1	40.3	49.1	62.5	60.0
Research performed internally (f)	12.9	31.8	16.4	8.1	14.5	17.5	2.5
Share of innovative products in sales (m)	33.9	48.6	40.3	26.0	46.5	35.0	21.9
Relative innovation staff (m)	15.6	38.7	16.4	11.3	33.3	8.9	3.0
Relative innovation budget (m)	11.0	24.1	12.1	7.9	18.2	8.9	6.1

[1] disregarding their location

[2] Introduction of product innovations new to the market or self-developed technologies

Source: SMEPOL-survey

Except for customers and suppliers, the providers of support programmes are the most important innovation partners. In the case of the control-SMEs these are primarily regional organizations, in the case of other firms they are most often national. Still, a significant number of test-SMEs did not see their relations to regional technology centres or national support programmes as important. Obviously, they often do not consider them as cooperation partners in the innovation process, but

rather as funding institutions or as “infrastructure”. It seems that the firms are not using the further knowledge of these institutions about innovations, contacts, markets, etc.

If the SMEs are differentiated by innovativeness, we see that with respect to universities, research organizations, training institutions, and public support the more innovative firms have generally more cooperations both on the regional and national level. This shows, in line with other evidence, that innovating firms are better networkers within the region and beyond.

The primary way to get into contact with innovation partners is unambiguously direct without the use of mediators. All samples have a percentage of around 97% of direct contacts. Considering this clear priority, SMEs of the test sample are the most active users of mediators (12%).

2 The main problems constraining innovation

High risk and lack of finance constrain innovation in particular in the case of the smallest SMEs:

The most serious problems constraining innovation are, according to the views of the respondents, the high risks of many innovation projects and a lack of financial means to fund innovation activities. Considering the fact that a lack of technical know-how does not belong to the most serious problems, it seems to be the commercial risk which is often a strong barrier constraining innovation. Another general constraint is the lack of time.

Problems like the inavailability of qualified personnel, deficits in marketing and commercialization, dominating external customers, and inavailable (i.e., missing or too expensive) technology are less frequent. In general, a lack of technical know-how is rarely seen as a serious constraint.

SMEs having received innovation support indicated problems more often as ‘impeding’ their innovation activities (increasing the costs or extending the time of an innovation project), but less as ‘preventing’ innovation projects. The latter is more frequent in the case of the SMEs of the control sample. Inavailable technology is more often a problem for the control- than the test-SMEs.

There are more differences regarding size-classes of SMEs. Specific problems for the smallest SMEs are a lack of finance, too high risk of innovation projects, and demands of customers (including secrecy). For firms between 10 and 49 employees technical problems (lack of know-how and equipment) and the lack of qualified personnel is more frequent. Larger SMEs are, in general, less affected by problems.

Innovative firms face different problems than less innovative. As to be expected, the non-innovators have more “preventing problems”. The lack of innovation in their case is not so much caused by “no need to innovate” but more by other problems such as a too high risk, a lack of finance and of time, as well as marketing problems. But also the innovative firms are confronted with barriers, nevertheless they differ between the types of innovators. For the more advanced innovators - those having products new to market or newly developed technologies - the high risk of innovation projects and the lack of finance are often considered as preventing problems. Less serious

("impeding") but still frequent are problems like a lack of time and marketing problems. For advanced product innovators further impeding problems are inavailable technology as well as dominating external demands. For product modifiers and technology adopters the pattern looks different. Firms adopting but not developing technologies by themselves seem to face less problems in general.

Are indicated problems really the needs? Or are firms "unaware" of specific problems?

In general, the importance of innovation as a strategy of competition has been recognized by most firms. That there is no need to innovate is only the view of a very small group of firms. Only a minority of SMEs restrict innovation to the objectives of cutting cost and improving productivity. Still, many firms seem to have a rather limited understanding of innovation. This can be concluded from the frequent motives 'quality advantage' and 'specialization on market niches' compared with the low frequency of 'diversification of the product range'. The perspective on innovation, thus, seems to be narrow. It is seen as a means to improve already existing strengths, especially regarding the own technical know-how trying to avoid competition through close relations to customers. There seems to be a lack of openness for stimulating influences - technological and commercial - beyond the field of experience accumulated in the past.

Is there some evidence in the survey for these aspects? Cooperations, especially outside the value chain and beyond the country or region, are undoubtedly important sources of information stimulating innovation. However, SMEs are only rarely engaged in such relations. Especially for SMEs without innovation support and those which are less innovative universities, research organizations, and technology centres are of negligible importance as partners in the innovation process. According to the survey results the most important reason not to cooperate is simply "no need". Cases of SMEs which have tried to establish cooperations but could not overcome barriers like costs, missing or not interested partners are clearly less frequent. This applies both to supported and not supported SMEs.

Another indication for this is the fact that many firms do not benefit from support instruments due to a lack of information about them. This reason is far more frequent than other problems like the inability to meet the required quality level of projects or inadequate criteria or focus areas. This indicates that many firms were not really interested in and/or have not searched for innovation support. This lack of information might have been reinforced, of course, by insufficient or uncoordinated dissemination activities of support providers.

3 Innovation support instruments for Upper Austrian SMEs

Direct support of innovation projects dominates:

Innovation support is dominated by direct support programmes offering grants and/or loans at favourate rates for innovation projects. Two national funds offer these programmes, the "Austrian Industrial Research Promotion Fund" (FFF) and the "ERP Fund". The FFF concentrates on research

projects and applied development, the ERP on the commercialization of innovations. Higher-risk innovation projects are, in general, supported through grants. This applies partly to the FFF-programme and completely to the ITF-programme which are both more R&D-oriented. The FFF uses a mix of grants and loans for the funding of an innovation project but offers the possibility to transform the loan into a grant in the case of a technical failure. The technical risk for the firm is therefore reduced according to the maximum extent of the support which covers up to 50% of the project volume. This is similar in the case of the other R&D-oriented programme, the ITF. The commercialization of innovations are lower-risk projects. They are therefore supported through loans at favourate rates by specific SME-oriented technology programmes of the ERP. Due to the fact that these funds have to be repaid, the reduction of risk for the innovating firm is very limited. This does not apply to the RIP-programme ("Regional Innovation Premium"), also focussing on commercialization, but by providing grants. The latter programme is a joint federal/provincial support instrument in particular for disadvantaged regions.

The programmes support a wide range of costs of innovation projects. This covers personnel, R&D-equipment, materials, consultancy, training, and contract research in the cases of FFF, ITF, and ERP-Technology programme. More oriented towards funding investments (including immaterial investments) are the ERP-SME-Technology programme and the RIP.

The average funds per project are dependent on the type of support. They are lower in the case of grants, ranging from about 170,000 (FFF and ITF) to 260,000 EURO (RIP). In the case of loans the amounts are of course higher, about 2 million EURO in the general technology programme and 1 million EURO in the specific SME programme of the ERP. The net value of the support, however, equals only the difference between the favourate and normal market rate of interest.

The second important instrument to support innovation are technology centres. In Upper Austria there are, at present, six centres. Two types of centres can be distinguished: incubation centres and innovation-oriented centres. Only two Upper Austrian technology centres are engaged in R&D and innovation. One centre - the Software Park in Hagenberg (close to Linz, the capital of the province) - is focussed on software development, the other - the Research and Training Centre for Labour and Technology in Steyr - on automation and telematics. Both centres have a mixed structure of members, university institutes, firms, and a technical college. Both centres can be characterized as small, local innovation networks between scientific and technical knowledge providers and entreprises. The other technology centres are incubation centres, offering facilities for young small firms. The centres are dominated by service firms, frequently data processing and software companies. Nevertheless, these centres are not strategically focussed on specific fields of technologies or industries.

In general, the technology centres in Upper Austria are not or to a very small extent engaged in technology transfer and consultancy as far as innovation is concerned. In some centres certain firms located there perform some of these functions through offering respective services. Especially, technology transfer seems to be a deficit, this function is hardly institutionalized in Upper Austria.

The province of Upper Austria offers some more innovation support programmes in addition to the support for regional technology centres, but they are very small compared to the national programmes. Their character is additional or complementary.

Slow shift towards the interactive model of innovation, but actual support is still primarily based on the linear model:

In Austria, like in other countries, there has been a move from general investment support and industrial policy towards a stronger emphasis of technology and innovation policy since the 1980s. Concerning the approach on the federal level, however, we can observe a considerable cleavage between a more progressive conceptual level and a rather traditional orientation of instruments. While the present technology policy concept ("Technologiepolitisches Konzept 1996") is strongly influenced by the interactive and systemic innovation model, most of the instruments are providing direct financial support for individual firms, still following the logic of the linear model. In fact, the most important instruments are organized according to the phases of the linear model: One fund (FWF, not investigated in this report) supports scientific projects and research mostly of universities and research organizations, another fund (FFF) aims at R&D-projects of firms of more applied character, and a third institution (ERP) supports the commercialization of innovations with several programmes.

In general, the direct financial support of firms through grants or loans is the most important type of instrument. Rather underdeveloped, despite much rhetoric, are knowledge and technolgy transfer, the strengthening of consultancy and business services, and the support of interfaces and networks. Regarding the national institutions, the activities based on the network paradigm (e.g., support for research cooperations by the FFF) are still very limited.

On the regional level it is the instrument 'technology centre' through which the network approach has been able to gain more influence in innovation policy. In its most recent strategic concept for technology policy (TMG, 1998), following the role model of Styria, Upper Austria is taking up the cluster- and networking approach more strongly. But it remains to be seen how fast and to which extent this new approach will actually materialize.

A new type of R&D-support - competence centres - will potentially improve the cooperative innovation activities of science and industry. In Upper Austria two centres have been recently established - Ranshofen focussing on light metals and Hagenberg (Software Park) focussing on software development - which will be supported by federal funds. Competence centres shall integrate industrial and scientific research focussed on a specific field of R&D. This shall be achieved by the participation of university institutes, research organizations, and several entreprises. To receive support by the national "K+" programme they had to pass an evaluation procedure about the scientific quality and economic usability (i.e., the commercial potential) of the intended R&D-activities. The "K+" programme supports competence centres for a limited time (up to 7 years, one renewal is possible) through grants. The maximum federal contribution is 35%, the minimum contribution of participating firms is 40%. Support is granted for investments (R&D-equipment)

and costs of operation. The integration of SMEs is an explicit objective. It is further required that several independent firms are participating to avoid domination by one company.

Insufficient strategic orientation of the innovation support system:

In general, the bottom-up-approach is predominant in the innovation support system. It is up to the companies to decide on the field of their R&D-activities. The acceptance of project applications is based only on the quality of the project and its degree of innovativeness, but not on a strategic technology policy. Only the ITF has a top-down-strategy with exactly defined technology focus areas.

In the case of some direct support instruments, especially those aiming at the commercialization of innovations like the RIP, the technological level and the degree of innovativeness is insufficiently checked before providing support. Of course, the standards of the evaluation procedures differ; they are higher in the more research-oriented programmes (FFF, ITF). It is an obvious problem of some direct support programmes (RIP) that the standards of innovativeness for granting support have additional character to other objectives like job creation and the development of structurally weak regions. This lowers inevitably the innovative character of projects.

The ITF, as the only top-down direct support instrument, is confronted with the problem to find a viable compromise between the attractiveness of technologies and the number of adequate firms. In this respect, the ITF was not successful in all of its focus areas. In some areas, there were simply too few companies actually engaged in R&D.

Most technology centres have no strategic technology focus. At present, there is one highly specialized “Software Park Hagenberg” with a clear focus. Most of the other centres do not select firms according to the type of their activities. In spite of this lack of strategic orientation, certain technologies are predominant in the centres. Most firms are engaged in software, information technologies, telematics, and related services.

Insufficient regional focus:

Most national support programmes have no definite regional orientation. Only one programme, RIP, explicitly focusses on regions with structural problems (old industrial and peripheral regions) and takes into account the regional effects of the supported projects. Unfortunately, this cooperative instrument between the federal state and the provinces (recently also the EU) is small compared to the big funding programmes of ERP and FFF. There is a further problem considering the effects of RIP on regional innovativeness: There is little emphasis on technology orientation. Supported projects include not only innovation projects but also new establishments and the expansion of plants which are considered as a structural improvement of the region.

The lack of regional orientation of the national innovation support instruments is no barrier for Upper Austrian firms to receive support since it is a relatively strong region. In fact, Upper Austria

is well represented in the national support programmes, its share of beneficiaries corresponds more or less to its share in Austria's manufacturing production and employment.

4 Effects of public innovation support

Direct effects on the innovation process of SMEs:

The most important direct effects are, from the perspective of the firms, support for the financing of investments (first) and personnel (second). Support for investments is the only effect which was mentioned by more than half of the SMEs having a strong impact on their innovation activities. Clearly less frequent, but still mentioned by more than 20% of the firms are the funding of external consulting services and the reduction of the risk of failure of a certain innovation project. The other effects were mentioned rarely. In this context it has to be considered that some effects can only be induced by a specific instrument. Such instrument-specific effects are in the case of technology centres 'provision of technical know-how', 'technical services' and 'provision of infrastructure' and in the case of direct support 'funding of investments/personnel/consultancy' and 'taking over of risk'. Due to the smaller number of SMEs benefiting from technology centres, the frequency of their specific effects in the whole test sample is low. But it is also low in the case of SMEs using their services or being located there. In general, firms find it hard to name the specific contribution of technology centres to their innovation activity. This seems to apply more for firms located there than for external firms which use their services, especially regarding the provision of technical know-how.

Further effects which can result potentially from both types of instruments are rare too. Obviously, the support instruments do not sufficiently target them. This applies most of all to market-oriented support like the provision of market information and the support for the commercialization of innovations. In the case of technology centres such effects were not indicated at all. As far as direct support programmes are concerned, the deficit regarding commercialization seems to be strange, because some of them (provided by the ERP) explicitly target commercialization. The reason is that these programmes aim at the technical aspects of implementing an innovation into regular production. What is missing is the support of the introduction of new products into the market and the penetration of markets. Further deficits seem to be the stimulation of cooperations, both with other firms and research institutions.

According to the data, direct support programmes seem to be more effective in supporting the innovation process of SMEs than technology centres. Of course, the primary effect is funding (especially investments followed by personnel). The stimulation of cooperations, the provision of market information, and the support for the commercialization of innovations play a minor role. It is interesting to observe that most effects are strongest in the case of firms having received combined support by technology centres and funding programmes.

Indirect effects on the supported SMEs:

Innovation support instruments can have indirect effects which can be either longer-term positive effects on the innovation process, emerging after the end of a specific project support or outlasting it. This can be the stimulation of a continuous or intensified innovation process and the support for new development opportunities such as the diversification into new markets. But it is also possible that there are other than innovation-related effects such as an increase in productivity and the creation of new jobs.

Nearly half of the respondents claimed that the support initiated a continuous or intensified innovation process beyond the supported project. At first glance this looks good. Nevertheless, it implies that the other half of the firms did not proceed to innovate, but, obviously, still regard innovation as occasional.

New opportunities for the development of the SME concentrate on the expansion within the same market. This applies to all types of instruments. Internationalization and the diversification into new markets is more frequent in the case of firms participating in direct support programmes than in firms located in or using services of technology centres. This may be due to the larger size of the involved SMEs.

In more than the half of the SMEs, the supported innovation projects or activities have led to a rising labour productivity. Labour productivity is more likely to be improved by direct support instruments than technology centres. An increase in capital productivity is less frequent.

The creation of new jobs is obviously favoured by most support instruments, more by direct support than technology centres. Nevertheless, about 73% of SMEs benefiting from technology centres indicated increasing employment, clearly more than SMEs in general or SMEs participating in direct support programmes. Obviously, growth is a general characteristic of these mostly young firms but has not been directly attributed to the specific support of the technology centres.

External effects on other firms:

Innovation cooperations with other firms is a rather frequent consequence of innovation support, most frequent in the case of firms using services of technology centres and some, but not all, direct support programmes. It is interesting that the initiation of such cooperations was less often mentioned. Obviously, many firms had already established relations before, but the support led to an intensification of these relations. Continuous cooperations with research institutions are less frequent than those with other firms.

Firms which have been founded due to the support for an innovation project are generally rare. It is comparatively more frequent in the case of SMEs located in technology centres which act often as incubation centres and the ERP-SME-Technology programme.

Positive effects on other firms (most often in the form of improved products or services) were frequently claimed. In the case of firms supported by technology centres, the effects seem to be more regional and customer-oriented. In the case of participants in direct support programmes, the effects are more national and more often benefiting suppliers too. Effects on other firms outside customer-supplier-relations are generally rare.

5 Do the effects of innovation support instruments meet the needs of SMEs?

Based on the comparison of the frequency of certain innovation barriers and certain effects of support instruments we will try to assess to what extent the instruments are able to meet the needs of SMEs regarding support for their innovation activities (see also tables IV.2, .3, .4, and .5).

Problems which are adequately matched by support instruments:

Funding, in general, is the most important need indicated by the SMEs. This problem is well matched by the direct support programmes. It is a specific effect of this type of support instrument; financial support for innovation is not offered by technology centres. Financial support is most effective regarding investments for innovation projects, followed by personnel costs, and, least but still frequent, costs of external consultancy. The effect of risk reduction resulting from this kind of support seems to be less recognized, but, nevertheless, was still frequently mentioned. Partly, this can be explained by the fact that it is the technological risk of the innovation project which is primarily reduced by direct support, but not the commercial risk of insufficient market success. The provision of infrastructure at favourate conditions is a specific effect of technology centres and, due to the small number of the centres' clients, rare in the total SME-sector. But also in the cases of SMEs benefiting from technology centres, this effect is rarely mentioned.

Problems like a lack of qualified personnel, inavailable technology, and a lack of time to concentrate on innovation projects are only partly met by the finance-related instruments. They can reduce cost-barriers, but not inaccessibility or inavailability. Overall, however, these problems are not very serious according to the views of most SMEs. Discrepancies between problems and effects seem to be more pronounced in the case of the smallest SMEs (1-9 employees), service firms, and certain industries with higher requirements of technological development like plastics and electro/electronics.

In general, financial support seems to be actually "overeffective". Strong effects were more frequently mentioned than serious problems in this respect. This is especially obvious in the case of the more innovative SMEs. This raises the question, if there is a significant share of the applied funds lost to firms and projects which do not really need them, but take them along as a welcome additional source of funding.

Effects and problems which are both not very important:

Technology-related innovation support (know-how- and technology transfer) does not seem to be very important for most SMEs. In the case of the rather few firms which indicated serious problems in this respect - especially the larger SMEs and the pastics industry -, both types of support instruments are not effective enough. Direct support through funding of innovation-related investments, technology centres primarily through the provision or mediation of know-how, less through services, obviously do not or cannot target the actual deficits.

Effects on marketing and commercialization and respective problems are nearly negligible according to the firms. Except for some industry-specific situations (wood, plastics), these aspects of innovation are obviously not considered to be very important by most SMEs. Only SMEs which have modified their products but not introduced any new products indicated to some extent deficits in their marketing capabilities (without any effects of the support instruments). The provision of maket information and support for commercialization are very rare effects. Technology centres are ineffective at all. Direct support, in spite of the fact that some of the programmes aim explicitly at the support of commercialization of innovations (ERP), cannot achieve significant effects. They aim at the technical aspects of commercialization, but neglect the introduction of new products into the markets.

Effects of the support instruments which do not meet important needs:

There are clearly deficits in the capability of support instruments to initiate innovation cooperations with firms as well as knowledge providers. This applies to both types of support instruments. Cooperation is a potentially important method to transfer technical and market know-how, to share expensive technical equipment (especially for R&D) or the respective costs of investment and operation, or to share the higher risk of more advanced innovation projects. However, many firms are not aware of these potential benefits of innovation partnerships. Concerning the reasons not to cooperate in the innovation process many survey firms simply indicated “no need” as the main reason.

This deficit applies in particular to the initiation of new collaborations. The support instruments are obviously more effective in the intensification of already existing relations, in transforming them from occasional contacts to continuous cooperations. Nevertheless, this positive effect is concentrated on innovation partnerships with customers and suppliers, the effects are far weaker in the case of cooperations with science. But due to the fact that collaborations of the latter type are generally less frequent than those with firms this hides the better relative performance of the support instruments, especially the technology centres. As far as cooperations with science are concerned, the support instruments could contribute to the intensification of most already existing relations with SMEs to become more permanent and important innovation partnerships for these firms (see also table IV.6).

Table IV.2: Correspondence of finance-related innovation problems and effects of support instruments (% of SMEs)

strong effect / preventing problem only	*All SMEs*	*Innovativeness **				*Benefiting from*		*Size (empl.)*		
		adv-anced	*modi-fiers*	*share of innov. products*		*Tech. centr.*	*Direct supp.*	*1-9*	*10-49*	*50-249*
				> av.	*< av.*					
n	140	77	46	36	71	22	67	55	40	40
Funding of investments	35.0	46.8	26.1	52.8	28.2	–	65.7	27.3	35.0	45.0
Funding of personnel	24.3	35.1	15.2	44.4	21.1	–	50.7	21.8	30.0	22.5
Funding of consultancy	16.4	15.6	21.7	19.4	16.9	–	31.3	7.3	22.5	22.5
Taking over of risk	12.9	19.5	6.5	22.2	14.1	–	25.4	14.5	12.5	12.5
Provision of infrastructure	0.7	0.0	2.2	2.8	0.0	4.5	–	1.8	0.0	0.0
⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓
Lack of finance	24.3	24.7	17.4	25.0	22.5	31.8	23.9	38.2	10.0	20.0
Lack of qualified personnel	10.7	5.2	19.6	13.9	8.5	4.5	9.0	10.9	15.0	7.5
Technology inavailable	12.1	14.3	8.7	5.6	14.1	9.1	7.5	9.1	15.0	15.0
Risk impossible to be taken	25.0	24.7	21.7	30.6	22.5	27.3	23.9	32.7	17.5	25.0
Lack of time	15.0	7.8	21.7	11.1	15.5	9.1	9.0	16.4	15.0	15.0

* Types of innovators: advanced innovators are those which have introduced products new to the market or developed technologies; modifiers are all other innovators (products modified or new for the firm only or technologies adopted only); share of innovative products > or < average (which equals 33.9% in the case of SMEs)

Source: SMEPOL-survey

Table IV.3: Correspondence of technology-related innovation problems and effects of support instruments (% of SMEs)

strong effect / preventing problem only	*All SMEs*	*Innovativeness **				*Benefiting from*		*Size (empl.)*		
		adv-anced	*modi-fiers*	*share of innov. products > av.*	*< av.*	*Tech. centr.*	*Direct supp.*	*1-9*	*10-49*	*50-249*
n	140	77	46	36	71	22	67	55	40	40
Provision of technical know-how	2.9	2.6	4.3	8.3	0.0	18.2	–	1.8	2.5	2.5
Technical services	2.1	2.6	2.2	5.6	1.4	9.1	–	3.6	0.0	2.5
Provision of infrastructure	0.7	0.0	2.2	2.8	0.0	4.5	–	1.8	0.0	0.0
⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓
Lack of technical know-how	6.4	5.2	8.7	5.6	7.0	0.0	4.5	5.5	12.5	2.5
Technology inavailable	12.1	14.3	8.7	5.6	14.1	9.1	7.5	9.1	15.0	15.0
Lack of qualified personnel	10.7	5.2	19.6	13.9	8.5	4.5	9.0	10.9	15.0	7.5

* See IV.2

Table IV.4: Correspondence of marketing/commercialization-related innovation problems and effects of support instruments (% of SMEs)

strong effect / preventing problem only	*All SMEs*	*Innovativeness **				*Benefiting from*		*Size (empl.)*		
		adv-anced	*modi-fiers*	*share of innov. products*		*Tech. centr.*	*Direct supp.*	*1-9*	*10-49*	*50-249*
				> av.	*< av.*					
n	140	77	46	36	71	22	67	55	40	40
Provision of market information	4.3	6.5	0.0	5.6	2.8	0.0	7.5	5.5	2.5	5.0
Support for commercialization	4.3	6.5	0.0	2.8	4.2	0.0	7.5	7.3	5.0	0.0
⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓
Marketing problems	7.1	2.6	10.9	2.8	8.5	4.5	1.5	9.1	7.5	5.0
External demands dominate	7.1	7.8	2.2	8.3	5.6	9.1	6.0	10.9	5.0	5.0
Customer requires secrecy	4.3	3.9	0.0	2.8	2.8	4.5	1.5	7.3	2.5	2.5
No need to innovate	5.0	3.9	6.5	8.3	2.8	9.1	7.5	3.6	7.5	5.0

* See IV.2

Table IV.5: Correspondence of cooperation-related innovation problems and effects of support instruments (% of SMEs)

strong effect / preventing problem only	*All SMEs*	*Innovativeness **				*Benefiting from*		*Size (empl.)*		
		adv-anced	*modi-fiers*	*share of innov. products > av.*	*< av.*	*Tech. centr.*	*Direct supp.*	*1-9*	*10-49*	*50-249*
n	140	77	46	36	71	22	67	55	40	40
Initiation of coop. with firms	4.3	6.5	0.0	8.3	2.8	9.1	9.0	3.6	2.5	5.0
Initiation of coop. with science	4.3	5.2	4.3	11.1	1.4	9.1	9.0	1.8	5.0	5.0
⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓
Lack of technical know-how	6.4	5.2	8.7	5.6	7.0	0.0	4.5	5.5	12.5	2.5
Technology inavailable	12.1	14.3	8.7	5.6	14.1	9.1	7.5	9.1	15.0	15.0
Marketing problems	7.1	2.6	10.9	2.8	8.5	4.5	1.5	9.1	7.5	5.0
External demands dominate	7.1	7.8	2.2	8.3	5.6	9.1	6.0	10.9	5.0	5.0
Risk impossible to be taken	25.0	24.7	21.7	30.6	22.5	27.3	23.9	32.7	17.5	25.0

* See IV.2

Table IV.6: Initiation of cooperations through the support instruments and innovation partnerships (% of SMEs)

		Cooperations with firms (customers/suppliers)					*Cooperation with science (universities/research org.)*				
	n	*initiated (1)*	*intensified (2)*	*(4)*	*important relations (3)*	*all*	*initiated (1)*	*intensified (2)*	*(4)*	*important relations (3)*	*all*
Types of innovators:											
Advanced innovators *	77	6.5	31.2	<	68.8	93.5	5.2	11.7	<!	14.3	40.3
Modifiers *	46	0.0	19.6	<	65.2	95.7	4.3	6.5	=!	6.5	21.7
Share of innovative products > av. *	36	8.3	38.9	<	77.8	97.2	11.1	16.7	<!	22.2	52.8
Share of innovative products < av. *	71	2.8	18.3	<	67.6	95.8	1.4	5.6	<!	7.0	25.4
Benefiting from											
technology centres	22	9.1	45.5	<!	68.2	86.4	9.1	22.7	=!	22.7	40.9
direct support	67	9.0	47.8	<!	68.7	95.5	9.0	17.9	<!	20.9	47.8
Size (empl.):											
1-9	55	3.6	20.0	<	56.4	78.2	1.8	7.3	=!	7.3	27.3
10-49	40	2.5	30.0	<	60.0	82.5	5.0	7.5	<!	12.5	27.5
50-249	40	5.0	22.5	<	65.0	92.5	5.0	7.5	<!	10.0	35.0
All SMEs	140	4.3	24.3	<	60.7	84.3	4.3	8.6	<!	10.0	30.0

(1) Initiation of cooperations (strong effect only); (2) Initiation of continuous cooperations; (3) External relations in the innovation process: important (continuous) cooperations versus any contacts; (4) Difference between continuous cooperations as a result of support and already existing important cooperations. "!" indicates cases where the support effect was mentioned by more than half of those firms with existing important cooperations.

* Types of innovators: advanced innovators are those which have introduced products new to the market or developed technologies; modifiers are all other innovators (products modified or new for the firm only or technologies adopted only); share of innovative products > or < average (which equals 33.9% in the case of SMEs)

Source: SMEPOL-survey

Necessity of support:

The impression that in particular direct support often produces "take-along"-effects is confirmed by the firms themselves (see table IV.7). Their assessment of the necessity of the received support shows that 16% of the participants of direct support programmes considered the co-funding not necessary for the respective innovation project. Further 30% qualified it as supporting, i.e., making it possible to conduct the innovation project at a larger scale or faster pace. Nevertheless, the project would have been carried out without support too. Only half of the SMEs were convinced that it would have been impossible to realize their innovation projects without direct support. In the case of firms supported by technology centres, however, the share of SMEs considering support as not necessary is smaller.

Table IV.7: The necessity of the support instruments for the realization of the innovation projects by type of SME (% of firms)

	n	*Necessary*	*Supporting*	*Not necessary*
Types of innovators:				
Advanced innovators *	77	32.5	19.5	13.0
Modifiers *	46	26.1	15.2	8.7
Share of innovative products > average *	36	47.2	30.6	2.8
Share of innovative products < average *	71	19.7	11.3	14.1
Benefiting from				
technology centres	22	50.0	13.6	4.5
direct support	67	52.2	29.9	16.4
Size (empl.):				
1-9	55	25.5	16.4	3.6
10-49	40	25.0	22.5	10.0
50-249	40	30.0	12.5	20.0
All SMEs	140	27.1	16.4	10.0

* Types of innovators: advanced innovators are those which have introduced products new to the market or developed technologies; modifiers are all other innovators (products modified or new for the firm only or technologies adopted only); share of innovative products > or < average (which equals 33.9% in the case of SMEs)

Source: SMEPOL-survey

SMEs which are more innovative seem to need support more urgently than those which are less innovative. This corresponds to the result that they are more seriously confronted with financial prolems and a too high risk of innovation projects. The opinion that support was not necessary was expressed most frequently by medium-sized firms (between 50 and 249 employees). Only very few of the smallest SMEs stated this assessment. A further result of the survey is that it is not reasonable to target support instruments along industries. This shows the example of the SMEs being engaged in electronics and the production of electrical equipment. This is the industry with one of the highest shares of SMEs assessing support both as necessary and not necessary.

6 The integration of the support instruments into the innovation system

National dominance in innovation policy:

The present study investigates the most important innovation support instruments provided by national and provincial institutions in Upper Austria - direct support instruments, providing grants and/or loans for innovation projects and respective investments, and technology centres. The direct support programmes aiming at innovation are mainly national institutions, administrated by two public organizations (FFF and ERP). Only one programme, the RIP is a joint programme between the state of Austria and most of its provinces. Nevertheless, also this programme is administrated by the ERP. The most important regional support instrument are technology centres. In the case of some centres (e.g., FAZAT, Technology Centre Innviertel), however, federal contributions, especially in the phase of foundation, can be substantial.

The fact that technology, R&D and innovation support is dominated by national institutions is primarily due to the very different funding capacities. In Austria the most important funding agencies are at the federal level while the provinces ("Bundesländer") have only little financial means to pursue their own policies. This situation urges them to cooperate with higher levels (federal state, EU-programmes) and to rely on cofinanced programmes, such as RIP on the national level and structurals funds on the level of the European Union. The combined funds of the national programmes selected for this investigation (FFF, ERP-Technology programme, ERP-SME-Technology programme, ITF and RIP) which were granted to Upper Austrian firms in 1997 were about 59 million EURO. The total R&D-budget of the province was about 17 million EURO in the same year.

Therefore, provincial activities to support innovation are mostly "soft", like stimulating the formation of clusters. Due to the financial restrictions only small amounts of money can be employed. This applies also to the most important innovation support instrument at the regional level - the technology centres. The dominance of the federal level with regard to financial capacity constrains ambitious initiatives of the provinces. A promising innovation support programme for the future, the provision of venture capital, will probably not be extended at the provincial level mainly due to the lack of funds.

Direct support is too dominant vis à vis technology centres:

The direct support programmes reach more SMEs than technology centres. Direct support dominates in particular in the plastics, metal and metal products industries. The clients of technology centres are more frequently the smallest SMEs and service firms. However, technology centres are not frequently used by external SMEs. As far as the test-SMEs are concerned, more than half of those who are using services from technology centres are also located there. Interestingly, services provided by technology centres seem to be more important for larger firms since a relatively large number of external companies use their services.

However, we are not arguing for a substitution of one instrument by another. The results of the survey lead to the conclusion that combined support by funding programmes and technology centres might be more effective in stimulating innovation in SMEs. This argument should not be restricted to these two types of instruments, but it should focus attention on the functional diversification of the whole innovation support system.

7 The main deficits in the innovation support system for SMEs

Direct support is a substitute for missing risk capital:

Direct support is in fact a substitute for risk capital which is not sufficiently available in Austria, especially as far as young and small innovative firms are concerned. The reason for this situation is the dominant role of banks and, accordingly, loans as external financial resources. There is often a close and long-lasting collaboration between a firm and a certain bank which is difficult to establish for new high-risk firms. Venture capital funds, private investors ('business angels'), institutional investors (like pension funds) are not sufficiently available. In addition, the Austrian stock exchange is of little importance, compared with other countries (Jud, 1997).

The Austrian venture capital market is still very young and grows slowly. The market is dominated by public funds, even if financial resources in the form of temporary equity capital like the Seed financing-programme of the ITF are offered. Another initiative of a public institution is the ERP-Special programme "Growth and Technology Offensive" which provides loans at favourate rates for R&D-projects under the condition that within 5 years they have to be substituted by private equity capital from the stock exchange, a private investor, or through corporate venturing (i.e., a strategic partnership), otherwise the loans become more expensive (i.e., the interest rates rise up to the usual market rates). These examples show that there are some activities to support the emergence of a risk capital market. Nevertheless, such a specialized market for young rapidly growing firms is still extremly small (Jud, 1997).

Considering the risk-problem as an important innovation barrier for small companies, direct support instruments have some weaknesses preventing them from being full substitutes for risk capital. Grants cover the risk of technical failure, but not the commercial risk of insufficient success after the innovation has been introduced into the market. The risk-reduction function of loans is even worse, because they have to be repaid (although at favourate rates) also when the innovation project fails. The FFF recognizes this problem by offering the possibility to transform loans into grants in such a case.

A further problem of the predominant role of direct support is the fact that they support innovation projects in a rather late phase of the innovation process. The project must be formulated in a detailed way already to have a chance to receive support. Project support does not stimulate innovation per se. A likely consequence is the support of many firms which are already innovative and which use the grants or favourate loans as additional sources of funds. As a consequence, a significant increase in the number of innovative firms cannot be expected.

Important sectors of the economy are not sufficiently benefiting from the innovation support system:

SMEs are not a specific target group of most direct support instruments. The only exception is the ERP-SME-Technology programme. Due to the SME-dominated structure of the Austrian economy, however, SMEs are actually the largest group of clients in all direct support programmes. Nevertheless, SMEs are still less represented in the direct support programmes than their share in the Austrian economy would require. This bias increases with the technological level and the orientation towards research. In these more advanced technological fields, large firms are strongly overrepresented. As far as technology centres are concerned it has to be distinguished between their function as incubation centre or business park - firms located in such centres are predominantly SMEs - and as providers of technology- and innovation-related services to external firms. In the latter case, it seems to be that large firms are using these services to a higher degree than SMEs.

According to the data published by the funding organizations **service firms** are of negligible importance as participants in direct support programmes. According to the survey, they are more frequent, but still below the participation rate of the SMEs in general. The conditions of these instruments are obviously inadequate for many service firms' innovation activities. On the contrary, technology centres host primarily service firms (software, engineering, etc.). We find a polarized situation: Direct support favours manufacturing, technology centres services.

Both types of instruments reach the **more innovative SMEs**. Technology centres seem to have a clientele which is more active in research, the participants of direct support have introduced more frequently advanced innovations than SMEs in general. Both have also higher shares of innovative products in their sales. One might argue that higher innovativeness is the result of innovation support, but, at least in the case of direct support, the argument that the instruments tend to support the already innovative firms is probably closer to the real situation. This follows from the interpretation of effects of support on the innovation process, problems constraining innovation, and the necessity of support (see section 5 of the conclusions).

Both types of support instruments reach those SMEs which are **more engaged in innovation cooperations**. This applies especially to firms benefiting from technology centres. Relations with innovation partners, and in particular with those from science, are more frequent than in the case of SMEs in general. The technology centres themselves, however, are only for few of their SME-clients important innovation partners, both for external firms and for firms which are located in the centres.

Elements/functions lacking in the innovation support system in Upper Austria:

The technology centres in the province are most often incubation centres, providers of facilities, but not consultants for innovation-relevant issues or technology transfer agents for the firms in the region. According to the survey, technological deficits do not seem to be the most serious ones. Other innovation-related support, especially in marketing, commercialization, and finance seems to be more important. That business-consultancy services are a very important function of technology centres which is often not sufficiently fulfilled is not a specific problem of Upper Austria, but

applies to most Austrian centres. In general, it does not seem to be reasonable to establish new technology centres. According to the necessity to locate such centres rather close to incubating institutions like universities or near larger agglomerations to reach the critical mass, they cannot be established all over the country. It is far more important to upgrade the existing technology centres (ÖIR, 1998). This applies also to the technology transfer function which is only performed in a rudimentary way at present.

The University of Linz is rather small compared with other university locations in Austria. In addition, the university is not specialized. To be an important element in the regional innovation system, the university is too broad in terms of represented disciplines for its size. In Upper Austria, industrial research performed in companies is predominant. But in the recent past, some promising institutions have emerged which could take over some of the missing functions of non-profit R&D and basic research in Upper Austria. Partly, these institutions are technology centres like the "Software Park Hagenberg" and the technology centre in Steyr (FAZAT). Partly, these functions might be performed by the new technical colleges, if they are better funded. The most important function of technical colleges, however, is not to perform R&D, but to provide training programmes at a level between universities and vocational training institutions. In this way they could become a very important source of technology transfer in the region. As far as industrial applied R&D is concerned, the establishment of competence centres which explicitly concentrate on this type of innovation activity will probably be an important element of diversification of the innovation system. At present, there are two centres in Upper Austria. According to the guidelines of the national competence centre programme "K+", these centres should employ about 30 persons scientific personnel, between 5 and 15 persons should be so-called "key scientists". These centres will be small, especially if they are compared with universities. The overall effect on the regional economy should therefore not be overestimated.

How stimulating is the support system for innovation? The problem of lock-in of support relations:

A special problem of the direct support programmes seems to be the emergence of long-term stable relations to a special clientele consisting of well-known innovative firms. This seriously reduces the capacity of these funds to stimulate innovation in other firms.

In the case of the FFF, industries which are more technology-intensive are the most frequent beneficiaries. Additionally, large firms, in spite of a small number of projects, receive a significant share of the funds due to the larger size of the projects. The impression is that it is a rather stable "club" of R&D-performing firms that benefits from the FFF. There were no strong and active efforts from the FFF to include new client groups and to broaden the number of firms engaged in R&D. This situation is reinforced by the fact that there is only an internal evaluation of the applied projects.

The ERP supports the transfer of R&D results into production and the commercialization phase through subsidized loans. In this procedure certain banks have a strong role since they have the contacts to the firms and they do a large part of the selection of projects. The question arises how projects are evaluated and how the program criteria are met.

Most SMEs having received support so far seem to be quite satisfied with the benefits, because most of them plan to apply for support in the future again (90%, only 10% deny this). This share is even higher in the case of firms which are not SMEs where 95% agree to do that. The SMEs of the control sample are clearly less willing to look for support, only one half plans to apply. This points to a cumulative nature of many support relations. Once firms have learned to use the specific support instruments, they find it easier to take advantage of them also in the future.

On the regional level it will be very important to avoid a situation where the focus lies on regional and local networks whereas relations to national and international potential innovation partners or sources of information are neglected. This is especially a danger of a too narrow cluster-perspective to reinforce competitiveness of regional business networks, of competition between the regions to attract firms, and of a lack of national coordination due to regional idiosyncrasies. It is a delicate balance between reinforcing regional networks and keeping them open for external influences which will be necessary to stimulate innovation in a region's economy.

8 Outline of strategies to improve the innovation support system for SMEs

The conclusions show that there are some deficits in the innovation support system for SMEs in Upper Austria. At the end of this report we want to present the basic lines along which, we think, strategic innovation policy for SMEs should be organized. It is a general orientation for particular measures still to be formulated in detail.

All innovation support instruments should increase their focus on SMEs:

At present, only few support instruments explicitly aim at SMEs. As a consequence, they do not target the most urgent needs of many SMEs as far as their innovation activities are concerned. It will not be possible, however, to find a single ideal type model for effective SME-support. The range of SMEs is very broad and needs differ significantly between firms of different size, which are active on different technological levels, and which belong to different industries. This means that any successful specific SME innovation support must necessarily be designed in a very diversified way to be able to cover these specific demands and to offer support which is adequate to the different capabilities of firms.

Instruments should try to raise awareness of other obstacles to innovation than finance:

Most SMEs consider the lack of funds as the most serious problems impeding or even preventing innovation. They are obviously not sufficiently aware of the importance of a lack of external relations in the innovation process. They provide crucial influences to stimulate and guide innovation beyond the long-established customer-supplier relations. To draw attention to these relations it will be necessary to provide information on market trends, customer needs, and recent technological developments continuously and in an attractive way in order to raise the interest of firms. Such information instruments should, on the one hand, offer a window on new opportunities

to SMEs, on the other hand, show them which deficits they have to realize these opportunities. Information policy must be diversified and targeted enough to provide information which is not too far away from accumulated experience of a certain group of SMEs. If the gap between experience and opportunity is too wide, SMEs will neither be willing nor able for such a venture. This function could be performed best by regional institutions (technology centres) which are more easily accessible for SMEs than national institutions not located in the region.

Support instruments must increasingly aim at improving innovativeness instead of supporting specific innovation projects:

At present, innovation support, especially direct support, reaches too often the already innovative firms. The effect on the overall innovativeness of the SME-sector would be certainly stronger, if the less or not innovative firms could be stimulated to increase or start innovation activities. It should become the primary objective to raise the number of innovative firms, not to reinforce activity of those firms which are already innovative. For this purpose it will be necessary, first, to engage in an active acquisition policy to attract new firms; second, to reduce the share of direct project support in favour of support for the improvement or even sometimes the creation of the capabilities to innovate. As a consequence, support for material investments will have to be reduced in favour of immaterial investments and costs of knowledge transfer and information acquisition, both commercial and technical. It will not be sufficient to support these activities financially, but to provide these services to a significant degree. Again, a lot of this work will have to be done by regional institutions.

In order to stimulate cooperative R&D the focus of support should be more on increasing the willingness and capacity to cooperate than on specific cooperation projects:

It is necessary to support the formation of networks of cooperative R&D instead of specific projects between a few innovation partners. It is difficult to stimulate certain cooperation projects, if the willingness and ability to cooperate is missing. If both are existing, on the other hand, joint R&D-projects do not need further external support. It is therefore more important to create or improve the institutional setting which favours or stimulates the establishment of innovation cooperations.

As far as inter-firm cooperations are concerned, supporting the intensification of relations between firms in order to establish clusters is basically a reasonable approach. In Upper Austria there seem to be preconditions in sectors like vehicles, plastics, metal/materials, software/“mechatronics”. It is a difficult task, however, to influence the emergence of clusters. Measures like providing information about potential areas of cooperation and customer-supplier relations or support of upgrading production in order to coordinate the product ranges of cluster-member firms have only indirect effects. It cannot be taken for granted that they will lead to clusters. Furthermore, a strategic technology-policy will have to pay attention to the structure of an emerging or existing cluster: Are they heterogenous enough to stimulate innovation? Are they equal and broad enough to avoid dominance by one or few firms? Are the relations between the firms intensive and open enough to make R&D-cooperation possible?

Cooperation in R&D between science and business can be supported by certain institutions where university institutes, research organizations, technical colleges, and companies (or at least their R&D-departments) work in close contact. Competence centres might be a good model, but such institutions are too rare and specific to have effects on a broad range of SMEs. The mediation of cooperation projects between firms and research institutions will still be necessary. This should become a clearly more important fuction of regional technology centres or specialized technology transfer agencies. Due to the fact that it is of crucial importance for the stimulation of innovation that a wide range of external influences can be accessed by the firms, a narrow focus on cooperations within the region must be avoided. Cooperations beyond the region are, especially regarding science, necessary in order to stimulate innovation of regional firms.

Innovation support must comprise market-related support:

At present, the innovation support instruments are strongly focussing on the technical side of innovation, the commercial side is neglected. It will be necessary to provide more consultancy services regarding market research and innovation management. For this purpose, the existing technology centres should be upgraded to be able to provide these services. The support system does not sufficiently target the introduction of new products into the market. Of course, direct support programmes could be extended on market introduction and penetration phases, but due to the fact that support would be restricted to specific projects, it cannot be an adequate substitute for risk capital. Therefore, support for a growing venture capital market is more important. These markets, however, are supraregional. Regional support would have to concentrate on information about and mediation of venture capital. Additionally, they should actively participate in public national venture capital funds.

Specific deficits in technology support have to be removed:

Technical support of innovation projects is quite effective but reaches only a small group of SMEs. The technical know-how and services offered are obviously not adequate for many firms. This means that technical support will have to cover a broader range of technologies and it will have to offer technology transfer services. This will be especially important for “low-tech” firms. At present, it is nearly impossible for them to find institutions which offer technical support they need. This means that existing technology centres will have to be upgraded extensively to be able to perform these tasks. Due to the fact that many of these services are unlikely to be profitable, public support for specific services will be necessary. When technology centres are able to offer a wider range of innovation support services, they will certainly increase their reach. At present, the number of external customers of Upper Austrian centres is too limited. In addition, the recently established technical colleges should be better funded to be able to perform applied R&D, primarily focussing on those fields of technology which are most important for regional firms.

The coordination of regional and national innovation policies should be improved:

In order to improve the accessibility of support instruments, to avoid redundant or incompatible programmes, and to combine specific regional and national strengths, it is necessary to coordinate regional and national innovation support activities. The objective is an integrated innovation support system where firms can contact "one-stop shops" (located in the technology centres, for example) for all innovation-related problems. Nevertheless, these regional institutions should not be restricted to providers of information and administrators of the programmes, but should act as an important source of information about needs of the firms regarding innovation support and as a source of feedback about the effects of the support instruments. This is necessary to improve and adapt support programmes continuously. Another subject is the coordination of technology/innovation policies of regions and the state of Austria. At present, there is a lack of cooperation between these two levels which is a barrier for an efficient innovation support policy.

V

ANNEX

The questionnaire for the company survey

Survey

Innovation in Upper Austrian Companies - the Role of Innovation Support

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Firm address:

1 Innovation activities

1.1 Has your company introduced any innovations regarding products or services in the past three years?

Yes ❍ No ❍

1.1.1 If so, are these innovations

modifications	❍
new products in your firm's product range	❍
new to the market	❍

(multiple answers possible)

1.2 What is the approximate share of the innovative products or services in total sales?

_____ %

1.3 Has your company introduced new technologies or processes* in the past three years?

Yes ❍ No ❍

** This comprises only technologies for the own production process. Technologies which have been developed for the market belong to the category "product innovation"!*

1.3.1 If so, are they

adoptions of already existing technologies	❍
technologies developed by your company	❍

(multiple answers possible)

1.3.2 What are the objectives for the introduction of new technologies

Increase of productivity	❍
Flexibilisation of production	❍
Improvement of product quality	❍
Technical basis for new products	❍

(multiple answers possible)

1.4 What is the budget, in % of sales, available for innovation activities per year?

_____ %

1.5 How many employees are primarily concerned with innovation (in full-time equivalents*)?

_____

** Example: 2 employees, working on average half of the day for innovations, result in an full-time equivalent of 1 employee.*

1.6 Which stages of the innovation process are performed by your company?

Research	❍
Development	❍
Modification / redesign	❍
Market research	❍

1.7 How did the innovation resources change in the past three years?

	Budget	Employees
increased	❍	❍
remained constant	❍	❍
decreased	❍	❍

1.8 What are your goals of innovation?

Competitive advantage	❍
Quality advantage	❍
Specialisation (market niche)	❍
Diversification	❍
Cost reduction / productivity increase	❍
Other goals	_____

(multiple answers possible)

1.9 Were there any significant innovations in the firm's organisation in the past three years?

Yes ❍ No ❍

1.9.1 If so, to which categories do they belong?

Outsourcing, subcontracting	❍
Flexibilisation (e.g. CIM, CAD/CAM)	❍
Quality management (e.g. ISO 9000)	❍
Decentralisation (e.g. profit centres)	❍
Networking (e.g. Internet, Intranet)	❍
Other	_____

(multiple answers possible)

1.10 Do some of the following factors impede or prevent innovation activities?

	No	Impede	Prevent
Insufficient funding	❍	❍	❍
Risk too high	❍	❍	❍
Dependence on external requirements	❍	❍	❍
Secrecy conditions of customers	❍	❍	❍
Insufficient technical know-how	❍	❍	❍
Technology not available or too expensive	❍	❍	❍
Problems with commercialisation	❍	❍	❍
Lack of qualified personnel	❍	❍	❍
Lack of time for innovative projects	❍	❍	❍
No need for innovations	❍	❍	❍

Other barriers _____

(multiple answers possible)

1.10.1 Which functions could be performed by public institutions in order to remove these barriers?

_____

2 Partners in the innovation process

2.1 With which partners do you cooperate in the innovation process?
Where are they located and how important are they?

Scale: *No entry = no importance* *1 = supporting, occasional cooperation* *2 = important, continuous cooperation*	Upper Austria	Other parts of Austria	Europe	Other parts of the world
Customers	1 2	1 2	1 2	1 2
Suppliers	1 2	1 2	1 2	1 2
Firms with similar products	1 2	1 2	1 2	1 2
Service companies	1 2	1 2	1 2	1 2
Universities	1 2	1 2	1 2	1 2
Other research institutions	1 2	1 2	1 2	1 2
Technology centres	1 2	1 2	1 2	1 2
Training institutions	1 2	1 2	1 2	1 2
Providers of subsidies	1 2	1 2	1 2	1 2

Other innovation partners _____

(multiple answers possible)

2.2 How did you get into contact with these innovation partners?

Directly ❍ Mediated ❍

2.2.1 In the case of mediated contacts, who are the mediators?

_____

2.3 If your company has no cooperations at all or does not cooperate with certain partners, what are the reasons?

No need	❍
Too expensive	❍
No adequate partners in the vicinity	❍
Contacted partners were not interested	❍
Other reasons	_____

(multiple answers possible)

3 The role of innovation support

3.1 Did your company receive direct support (grants or favoured loans) for finished or ongoing innovation- or R&D-projects?

Yes ❍ No ❍

3.1.1 If so, which are the institutions or programmes?

FFF (Forschungsförderungsfonds)	❍	
ERP-Technology programme	❍	
ERP-SME-Technology programme	❍	
Other ERP-programmes	❍	Which ones? _____
ITF (Innovations- und Technologiefonds)	❍	
RIP (Regionale Innovationsprämie)	❍	
Support from the province of Upper Austria	❍	Which ones? _____
EU-programmes	❍	Which ones? _____
Other programmes		_____

(multiple answers possible)

3.2 Do you use services provided by technology centres, technology transfer institutions or innovation consultants?

Yes ❍ No ❍

3.2.1 If so, of which kind are these services? _____

3.2.2 Where is the institution located? _____

3.3 Did you get risk capital?

Directly from a private investor	❍
From a venture capital fund	❍
No risk capital	❍

3.3.1 In the case of a venture capital fund, is it a

regional fund	❍
Austrian fund	❍
European fund	❍

3.3.2 How long is the time period of the risk share? _____

3.3.3 What is the share? _____ %

3.4 Do you intend to apply for support or to use support services in the case of future projects?

Yes ❍ No ❍

3.5 What were the direct effects of the support for the innovation projects or activities?

	no effect	slight effect	strong effect
Funding of personnel	❍	❍	❍
Funding of investments	❍	❍	❍
Funding of consultancy	❍	❍	❍
Access to technical services	❍	❍	❍
Gaining technical know-how	❍	❍	❍
Market information	❍	❍	❍
Support for commercialisation	❍	❍	❍
Reduction of risk	❍	❍	❍
Initiation of cooperations with firms	❍	❍	❍
Initiation of cooperations with science	❍	❍	❍
Availability of infrastructure	❍	❍	❍

Other effects _____

(multiple answers possible)

3.5.1 Please describe the most important effects:

_____

3.6 Did the support for your innovation activities result in an increase of productivity?

Labour productivity ❍
Capital productivity ❍
No change ❍

(multiple answers possible)

3.7 Did the support for your innovation activities open up new development perspectives for the company?

Internationalisation ❍
Diversification into new markets ❍
Expansion within the same market ❍
No change ❍

(multiple answers possible)

3.8 Did the support for your innovation activities create new jobs?

Yes ❍ No ❍

3.9 Did the support for your innovation activities lead to continuous cooperations

with other companies ❍
with research institutions ❍
with other partners _____

(multiple answers possible)

3.10 Did the support for your innovation activities trigger the start-up or spin-off of a new firm?

Yes ❍ No ❍

3.11 Did the support for your innovation activities lead to a continuous or intensified innovation process (e.g. follow-up projects) in the company?

Yes ❍ No ❍

3.12 Are there other follow-up effects of the support? If so, please describe them:

_____

3.13 Could other firms benefit from the support for your innovation activities?

Yes ❍ No ❍

3.13.1 If so, are they located

in Upper Austria ❍
outside the province ❍

(multiple answers possible)

3.13.2 Are they your

customers	❍
suppliers	❍
other firms	❍

(multiple answers possible)

3.13.3 In what way could they benefit?

_____

3.14 How important was the support for the realisation of the innovation project

necessary	❍
supporting, enabling a larger scale	❍
not necessary	❍

3.15 Did the support lead to unintended effects?

_____

3.16 Are there any effects which you strived for but could not achieve?

_____

3.17 How do you assess the administration of the support institutions?

	Positive	Indifferent	Negative
Provision of information	❍	❍	❍
Consulting	❍	❍	❍
Time for administrative processings	❍	❍	❍
Administration expenditures	❍	❍	❍
Accessibility	❍	❍	❍
Reliability	❍	❍	❍

Other aspects _____

(multiple answers possible)

3.18 If you did not receive support so far, what are the reasons?

No need	❍
Too costly application/documentation	❍
Lack of information	❍
Quality requirements too high	❍
Inadequate criteria for selection/focus areas	❍

Other reasons _____

(multiple answers possible)

4 Company features

4.1 Present number of employees:	/	Change within the past three years:	
_____		increasing	❍
		constant	❍
		decreasing	❍

4.2 Present turnover:	/	Change within the past three years:	
_____ ATS		increasing	❍
		constant	❍
		decreasing	❍

4.3 Ownership:

Fully independent		❍
Share of another firm	25%	❍
Share of another firm	50%	❍
Share of another firm	100%	❍

4.4 Year of formation: _____

4.5 The main products and services:

1)_____2)_____3)_____

4.5.1 What is the type of production?

Standardised, mass production	❍
Flexible, small batch	❍
Customer specified	❍

4.6 Where are your main markets located (approximate share in total sales and purchasing)?

	Sales markets	Purchasing markets
Upper Austria	_____ %	_____ %
Other parts of Austria	_____ %	_____ %
Europe	_____ %	_____ %
Other parts of Europe	_____ %	_____ %
Sum	100 %	100 %

Thank you for completing the questionnaire!

Are you interested in a summary of the results? Yes ❍ No ❍

VI

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Leichtmetall-Kompetenzzentrum Ranshofen des Forschungszentrums Seibersdorf: http://www1.arcs.ac.at/fzs/ransho.html (7/98)

Oberösterreichische Technologie- und Marketinggesellschaft: http://www.tmg.or.at/...

Regionale Planungs- und Entwicklungsgesellschaft Vöckla-Ager: http://www.reva.or.at/...

Technologiezentrum Linz: http://www.tcs.co.at/vtoe/oboe/tzl/...

Techno-Z Innviertel: http://www.tzi.at/...

Vereinigung der Technologiezentren Österreichs: http://www.tcs.co.at/vtoe/...

Wirtschaftsberatungs- und Ansiedlungsgesellschaft Wels: http://www.wba-wels.co.at/...

Wirtschaftskammer Oberösterreich: http://www.wk.or.at/w3wkooe/...

d) Data

Amt der Oberösterreichischen Landesregierung (OÖ LReg)
ERP-Fonds
Forschungsförderungsfonds für die gewerbliche Wirtschaft (FFF)
Hauptverband der österreichischen Sozialversicherungsträger
Innovations- und Technologiefonds (ITF)
Oberösterreichische Technologie- und Marketinggesellschaft (TMG)
Österreichisches Statistisches Zentralamt (ÖSTAT)
Wirtschaftkammer Österreich (WK OÖ)

e) Interviews

ERP: Ms Küpper
FAZAT: Mr Jarosch
FFF: Mr Schnitzer
GTZ/WBA: Mr Reischauer
ITF: Mr Anderle
SWP: Mr Zauner
TMG: Mr Bayer

f) Exchange rate ATS - EURO

1 EURO = 13.7603 ATS

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