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New Technology and Regional Development in the European Snowbelt towards a New Emerging Network?

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1. Prologue

Economic dynamics has always been accompanied by spatial dynamics: economic heartlands come and go. The economic history of mankind shows many fluctuations in the functioning of major economic power blocks. For example, the dominant position of Western Europe is in fact fairly recent (see Olson, 1982). But also within Western Europe remarkable shifts can be observed in the past centuries, for instance, from Italy to the Iberian Peninsula and next to North-West Europe. Especially after the Industrial Revolution major changes have taken place in Europe, in which - besides geographical shifts of economic core areas - also drastic (inter)sectoral shifts could be observed (cf. Suarez-Villa, 1989). In recent years there is an increasing recognition of the rise in economic importance of regions around the Alps, the 'European Snowbelt'. This snowbelt comprises the following regions: Baden-Württemberg, Lombardia, Rhône-Alpes, Provence-Alpes-Côte d'Azur, and Switzerland and Austria. The rapid growth of the European Snowbelt is not only reflected in the rise in service employment in these areas, but also in the emergence of innovative new technology firms. This development seems to confirm the popular view that industries of tomorrow are not being established in industry regions of the past.

Our paper aims to analyze the question whether technological innovations form the background of the economic development of the European Snowbelt and whether this area offers favourable incubator conditions for new technology in the European network system. After a concise survey of some important general issues in the field of space, development and technology, the various regions in the European Snowbelt will briefly be reviewed, in order to test the above assumptions on the competitive position of this area.

2. Innovation and New Technology

Innovation and new technology have been focal points of economic research in the past decade (see for a survey Davelaar 1990). Neo-Schumpeterian paradigms have played a major role in the economic analysis of new technological regimes (Freeman, 1986; Kleinknecht, 1987). A stage of an economic upswing is usually induced by the simultaneous development (and successful application) of several major

technological breakthroughs in a limited number of sectors, which through process and product innovations lead to a rapid rise in productivity, efficiency and market coverage of firms. Such key sectors penetrate the whole economy, so that especially the intensity of diffusion of new technological findings is a critical variable (see Ewers and Wettmann, 1980 and Keeble and Wever, 1986).

The 'new frontier' sectors are not randomly distributed over all nations or regions of an economic system, but are clustered in space and time. They are in particular concentrated in those regions which offer favourable seedbed conditions for new and successful initiatives (see Cappellin and Nijkamp, 1990). Regions with an open attitude towards new developments, with an economic multifunctionality with favourable communication networks and with sufficient flexibility in politics and organisational networks tend to become the winners in this competitive game (see Ewers and Gornig, 1990). In general, advanced regions appear to have better access to all such incubator conditions, and as a consequence regional dynamics and economic dynamics are often two sides of the same medal (cf. Hall 1985).

Clearly, there may be significant variation in the development of a regional system compared to that of the nation as a whole, as the seedbed conditions for new technologies show much difference. Consequently, different countries may exhibit large differences in regional transformation processes. Some evidence on this observation can also be found in a recent cross - comparative study on the evolution of urban agglomerations in various countries (see Nijkamp, 1990).

Thus, Schumpeterian waves of economic restructuring appear to discriminate among various regions or cities (Galbraith, 1985; Porter, 1990). In the past decade especially the information and communication sector is often regarded as the key sector in the so-called fifth Kondratieff wave (see Hepworth, 1989). This sector comprises inter alia computers, electronic capital goods, telecommunications equipment, optical fibres, robotics, ceramics, data banks, information services, micro - electronics and biotechnology. The knowledge and information component appear to be extremely important in this new technology sector, which has some authors led to the conviction, that so-called 3C-regions (regions with creativity, competence and com-

munication) are the most promising areas for spatial - economic dynamics (cf. Andersson, 1985).

The new technology sector does not only use advanced equipment, but is also geared toward tailor-made production or service delivery and is at the same time flexible with respect to new market requirements (cf. Malecki, 1985). Furthermore, the competition in the new technology sector is often strong.

It is noteworthy that the precise demarcation of the new technology sector is usually fraught with many difficulties (Malecki, 1987). The following indicators are often used in empirical research: intensity of R&D, share of highly skilled labour force, extent of risk investments, share in public financing for research, degree of patents and licenses obtained, speed of outdating of new products and production processes etc.

Very often the degree of innovation of a sector (or a region) is measured by means of employment growth, although in various cases also R&D expenditures, patents, productivity (or profit) rise or rise in market shares is being used. Nevertheless, a sharp definition of the new technology sector appears hard to obtain (see Pottier, 1985), although there is a common opinion that in most cases information technology, biotechnology and medical technology, new materials technology, and energy technology belong to the new technology frontier. Therefore, in our paper we will follow this common notion on the coverage of the new technology regime.

3. Innovation and Space

The creation of a 'new technology' niche in a region is often regarded as a guarantee for regional revitalisation. However, the regional innovation potential is a multi-faceted phenomenon which shows much variation, as is also witnessed by Silicon Valley, the Greater Boston area, the London-Bristol corridor, the Dutch Randstad, or the greater Barcelona area. Thus it is not possible to estimate a priori a survival rate or a success rate of innovative regions. Furthermore, such areas are very sensitive to economic business cycles, especially as far as the routine (often mass) production is concerned that is related to basic innovations. 'Farming out' of

standardized products associated with innovative activities has become common practice.

In this context, Johansson (1987) makes a distinction into knowledge-intensive, service-oriented and production activities. The innovative potential of a region is mainly determined by knowledge intensity, to a lesser degree by service delivery and to low degree by executive production and goods handling (cf. also Weiss, 1985).

Empirical evidence has shown that in a national system of regions specific areas with an apparently high economic potential continue to exist and that such regions are often also able to generate spin-offs to other areas (Markusen et al., 1986). Traditional location theories fail to provide a satisfactory explanation for spatial dynamics related to technological innovation. Not only has the (mainly footloose) service sector become much more important, but also qualitative aspects of the labour market, new forms of industrial organisation and complex network configurations in which many firms operate have exerted a far reaching impact on entre-preneurial decision making.

The innovative potential of a region is thus a complicated interplay of the regional production environment and the regional production structure (cf. Coffey and Polèse, 1984). In almost all cases, a minimum set of critical success factors appears to play a decisive role for innovative potential. These factors are: an efficient physical network structure and communication infrastructure (Markusen, 1985; Oakey et al., 1985); a good quality of life and a high amenity environment (Hall, 1985; Molle, 1985; Rees and Stafford, 1986); an academic research climate (Breheny et al., 1985; Markusen, 1985; Saxenian, 1985); the presence of an urban agglomeration (Davelaar, 1990; Nijkamp et al., 1990; Storper and Scott, 1989; Thomas, 1986; Whetten, 1987). Since some years there is a growing interest for the role of networkstructures in the explanation for spatial dynamics related to technological innovation. In the next paragraph we will discuss some aspects related to this issue.

4. Network Structures and Technological Innovation

For the development of innovative new technology firms the presence of network structures also functions as a seedbed condition.

Technological development (or innovation) is nowadays increasingly regarded as a collective phenomenon of interaction between a multitude of actors. Innovations become the product of a network of actors (Lecoq, 1990). In this context, we can distinguish physical networks and social-economic networks. The first refers to infrastructure and telecommunication networks and the latter to networks based on inter-relations between different actors for different purposes (for example because of the interchange of knowledge, goods and/or information; see Ewers and Wettmann, 1980). Of course these two kinds of networks cannot be seen as totally separated, because they are inter-dependent configurations of economic actors.

Like for any kind of economic activity, it is also for innovative technological activities important to have access to high quality infrastructure and telecommunication networks. These networks provide contact and communication possibilities between the various actors and are an important factor in the competitive position (Kamann and Boekema, 1989). In the near future all networks wil play a critical role in the interchange of information, because the increasing importance of the service sector and the knowledge component in industrial products requires integrated network configurations. The latter is a specific characteristic for innovative technological activities: products in this field have a very high knowledge component. This knowledge component concerns not only scientific knowledge but also informal knowledge concerning product technology, materials used, successful product/market combinations etc. It goes without saying that also learning-by-doing and learning-by-using obtained by means of relationships with suppliers, consumers and even competitors are important in this respect.

Differences in relationships between economic actors in social-economic networks are an important factor in explaining the differences in the development of regions concerning specific sectors (Dunford, 1989). The actors do not only pertain to various entrepeneurs in the production domain, but also to actors in an institutional setting (government institutions, unions etc.) and supporting services

(financial institutions, marketing offices etc.). Specifically for innovative high technological activities it is important to have (more or less formal) relationships that lead to technological transformation and the diffusion of technological know-how. Knowledge networks play a crucial role in the success of technological innovation (Gelsing, 1989). Therefore, it is evident that high technological firms have to be located in an infrastructure network of a high quality.
An up-to-date information - by using network relations - is also important for the sectors active in the high-tec area because of drastic fast changes in the market and the demand for customized products. In practice, this leads to network formations like combined research projects, combined knowledge enlistment etc. Innovative and technological activities cannot any more only be explained by technoloy-push or demand-pull theories. These kind of activities are increasingly the result of an active cooperation between various actors in the high-tec sector. The costly research and development activities are in many cases only possible when the different actors make use of synergetic effects. Besides, nowadays a technological innovation is most of the time a result of different small innovations.

Each actor in a social-economic network has his own set of other - more or less relevant - actors. The more important actors he has in his enviroment the higher the change that he will be successful in his activities (Kamann, 1988). When one is dealing with innovative high technological activities - with a high knowledge component - the sensitivity of distance to other actors is high. Therefore, it is for this kind of activities important to be settled within the nodal point of a specific network. Urban and regional centers function as a rule as nodal points for both the physical and social-economic networks in a hierarchical structure. The location of high-tech activities may be expected to be present in these nodal points of a spatial network (Nijkamp et al., 1990). However, since some years it seems that different urban centers can perform at the same level. This might lead to a multi-polar structure of urban and regional centers. Also it seems that the development of a network for new activities (for example, innovative activities) is much easier in an environment not

dominated by an old structural network (Kamann, 1989). Besides, in Europe traditional patterns of competition - within national borders - are increasingly being replaced by vigourous competition on a multi-national scale, since traditional boundaries disappear. Regions of different countries are becoming part of an economic network. These developments could lead to a tendency in which large metropolises are losing part of their innovative potential in favour of medium-sized cities (Malecki, 1983). The network economies in the French regions Provence-Alpes-Côte-d'Azur en Languedoc Rousillon based on innovative small and medium-sized companies maintaining linkages among themselves and with large enterprises could function as example. Here various forms of expertise in collaborative networks transcend the older types of industrial strategy based on internal concentration (Hansen, 1990). Besides these French regions the " Third Italy " is an example of a territorial netwerk of small businesses maintaining more or less formal relations (Lecoq, 1990).

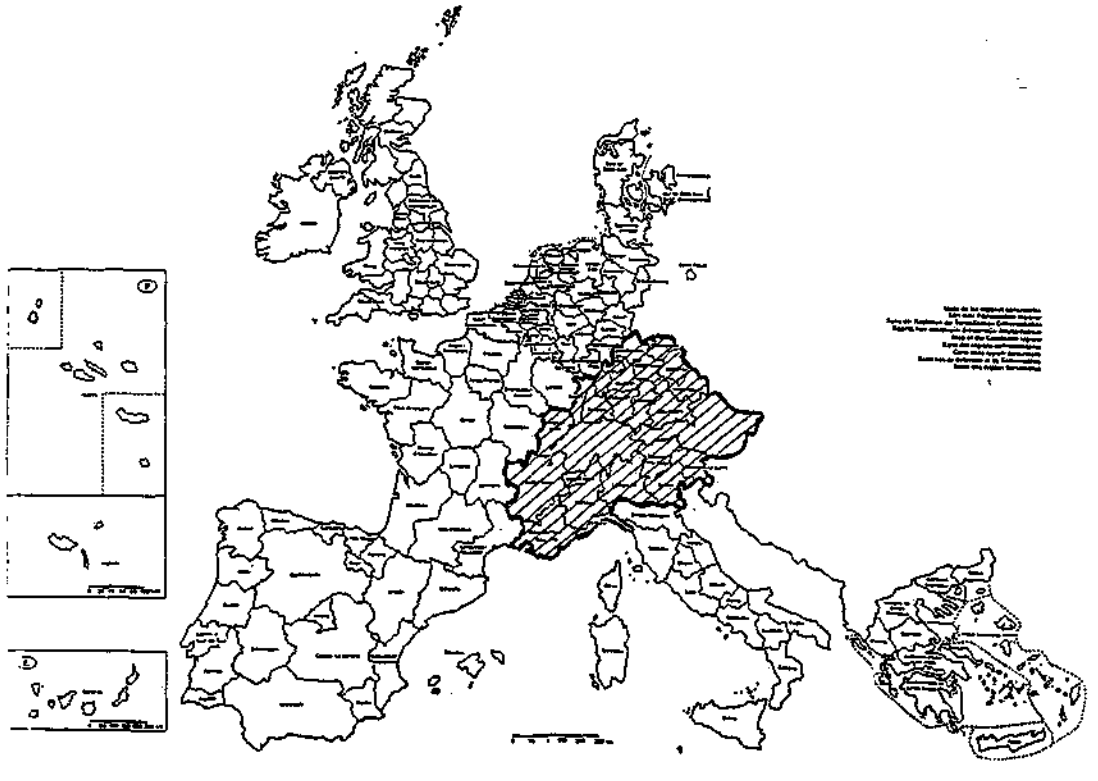
Having presented now in a nutshell various considerations regarding the economic geographical driving forces of regional innovative behaviour, we will in the next section provide some empirical material on the development of the European Snowbelt as a frame of reference for judging the validity of the above considerations.

5. The European Snowbelt: Some Facts

The geographic delineation of the European Snowbelt and its constituent regions is given in Map 1. This subdivision is based on the so-called NUTS classification used by the Eurostat Bureau of the European Community.

Due to lack of statistical data from Eurostat Austria and Switzerland could not be further subdivided. In this section some general regional indicators will be presented, viz: population, gross national and regional product and employment.

Country	Region	
Germany	Baden-Württemberg	Karlsruhe
		Stuttgart
		Freiburg
		Tübingen
	Bayern	Unterfranken
		Oberfranken
		Mittelfranken
		Oberpfalz
		Schwaben
		Niederbayern
		Oberbayern
Italy	Nord-Ovest	Piemonte
		Valle d'Aosta
		Liguria
	Lombardia	
	Nord-Est	Trentino-Alto Adige
		Veneto
		Friuli-Venezia Giulia
France		Alsace
		Franche-Comté
		Rhône-Alpes
		Provence-Alpes-Côte d'Azur
Switzerland	Total	
Austria	Total	



Map 1: The European Snowbelt and its constituent regions.

4.1 Population

Figure 1 gives a presentation of the demographic developments in the regions under consideration.

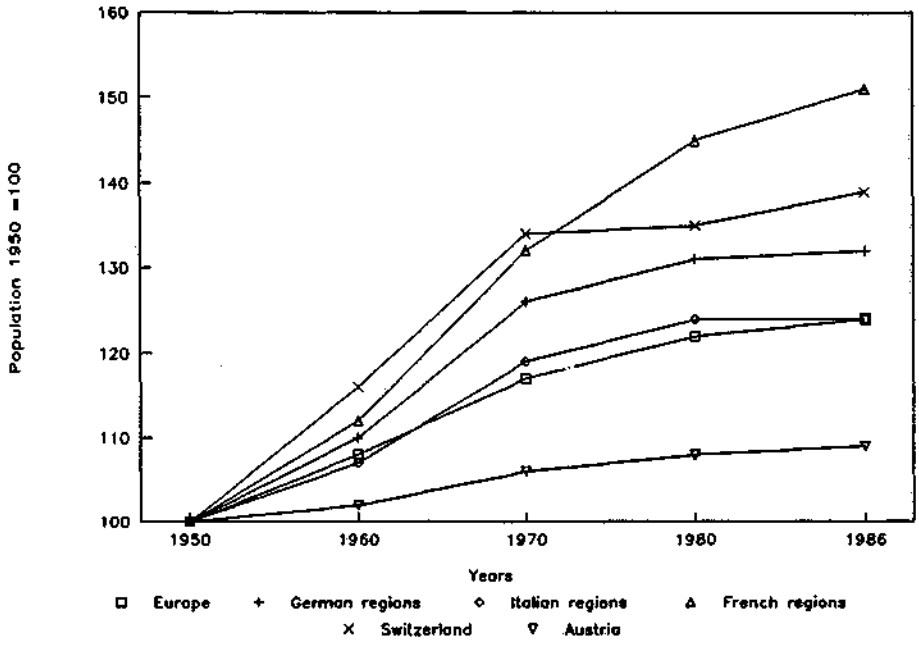


Fig. 1. Population growth for the period 1950-1986

It appears that all regions in the European Snowbelt - with the exception of Austria - have exhibited a relatively strong population growth compared to Europe as a whole. Especially the four French regions have grown fast, followed by Switzerland and the German regions. A more detailed investigation of the available data material leads to the conclusion that in France the regions Rhône-Alpes and Provence-Alpes-Côte d'Azur and in Germany the region Baden-Württemberg have the highest growth rates. The Italian regions run more or less parallel to Europe as a whole, be it that Lombardia has the highest regional growth in Italy.

5.2 Gross National Product

Data on GNP per region are difficult to obtain. Therefore, in our description of data results we have only presented data on GNP for the years 1950 and 1985 (see Figure 2). Unfortunately a comparison with Europe as a whole was not possible, so that only the regional data for

France, Germany and Italy are given here.

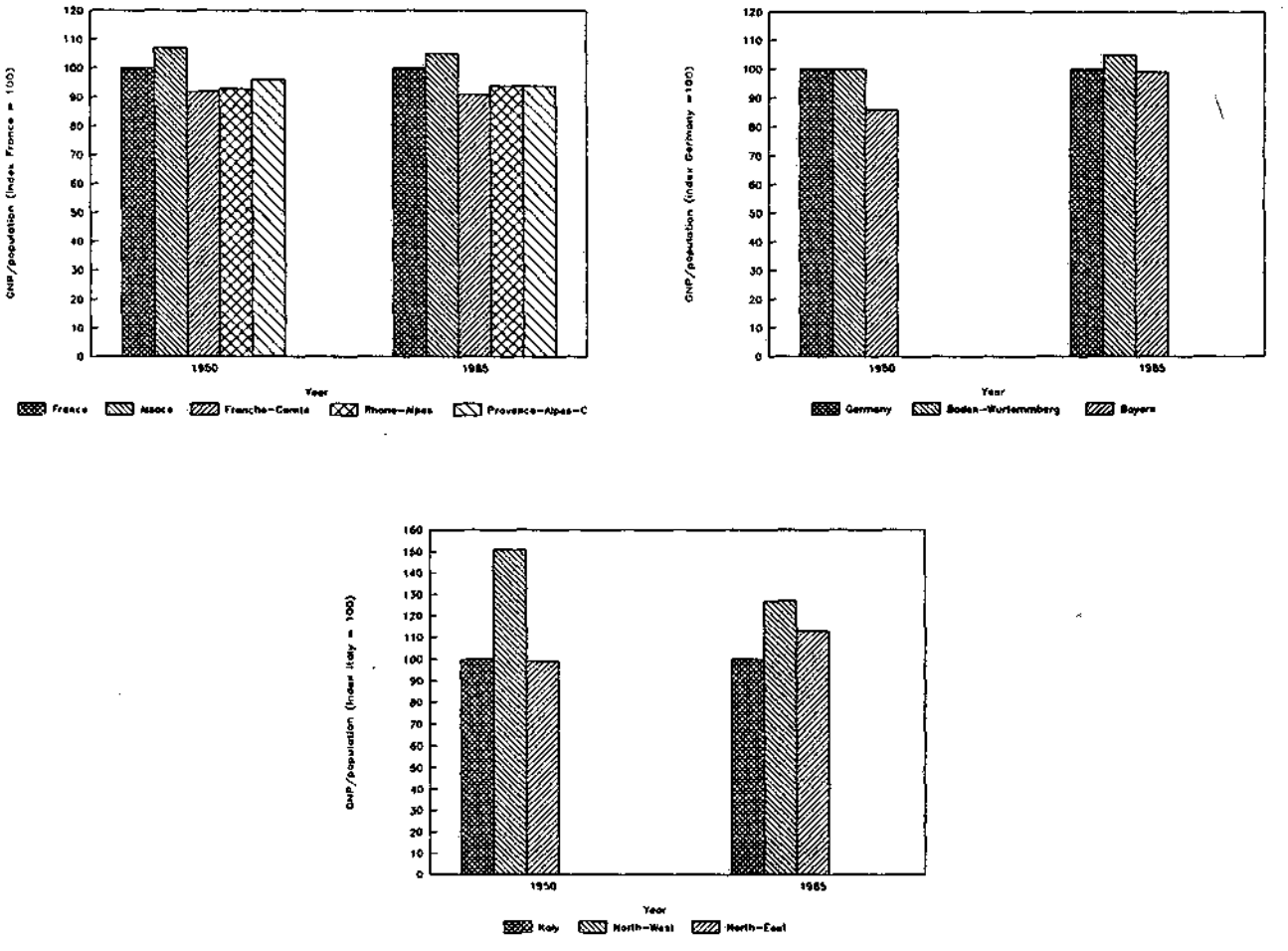


Fig. 2. GNP per capita for the years 1950 and 1980; index GNP for each country = 100

Both German regions under consideration appear to have a better performance than Germany as a whole; this holds in particular for Baden-Württemberg, while the growth of Bayern (Bavaria) is apparently characterized by a 'catching-up' manoeuvre.

Also the Italian regions showed a remarkable achievement, especially Nord-Ovest, although Nord-Est appeared to have a higher growth rate. Both regions exhibit now a converging process at a higher growth rate than Italy as a whole.

The four French regions show a pattern which is more or less equal to the French average with the exception of the relatively better

performance of Alsace.

5.3 Employment in three main sectors

The employment data are subdivided according to three main sectors: agriculture, industry and services. The data for the period 1970 - 1984 are given in Figures 3-5, respectively.

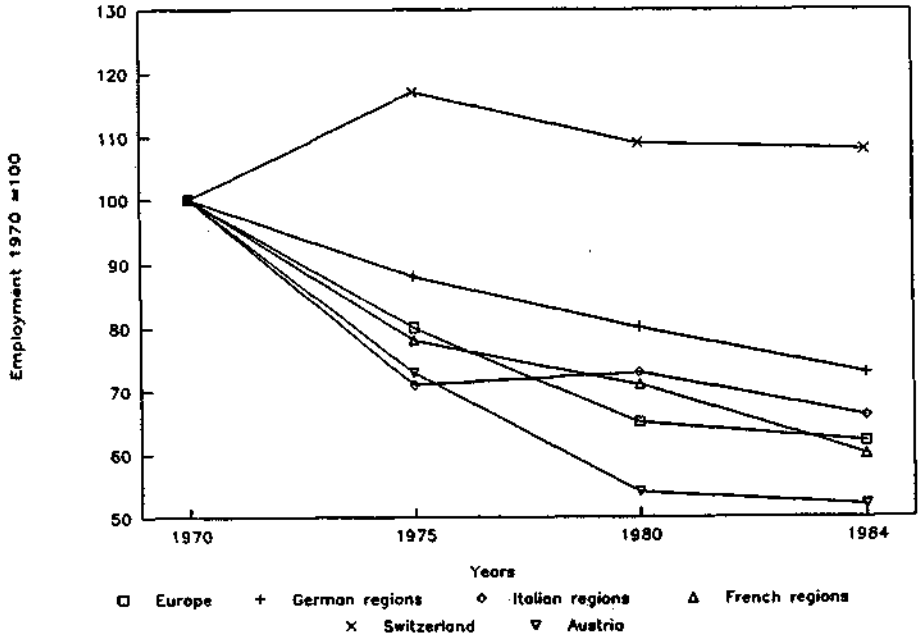


Fig. 3. Employment development in the agricultural sector for the period 1970-1984

The agricultural sector appears to follow largely the European trend, with the clean exception of Switzerland where agriculture is much less a declining sector (which is related to the strong Swiss food industry).

The industrial sector in almost all regions at hand is also marked by fairly uniform development processes, i.e., a decline in industrial employment. In this framework Austria offers a clear exception, which may be due to the strong public support for the Austrian industry, a situation which is gradually changing and which will also make Austria follow the European trend. It is worth mentioning however, that thus far all regions considered have still an industrial employment level which is above the European average.

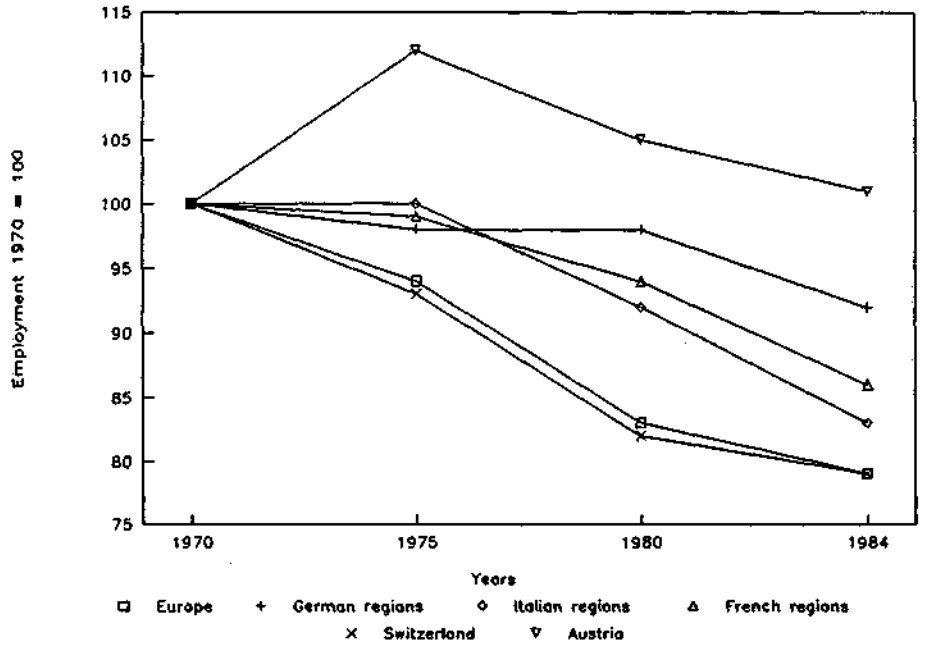


Fig. 4. Employment development in the industrial sector for the period 1970-1984

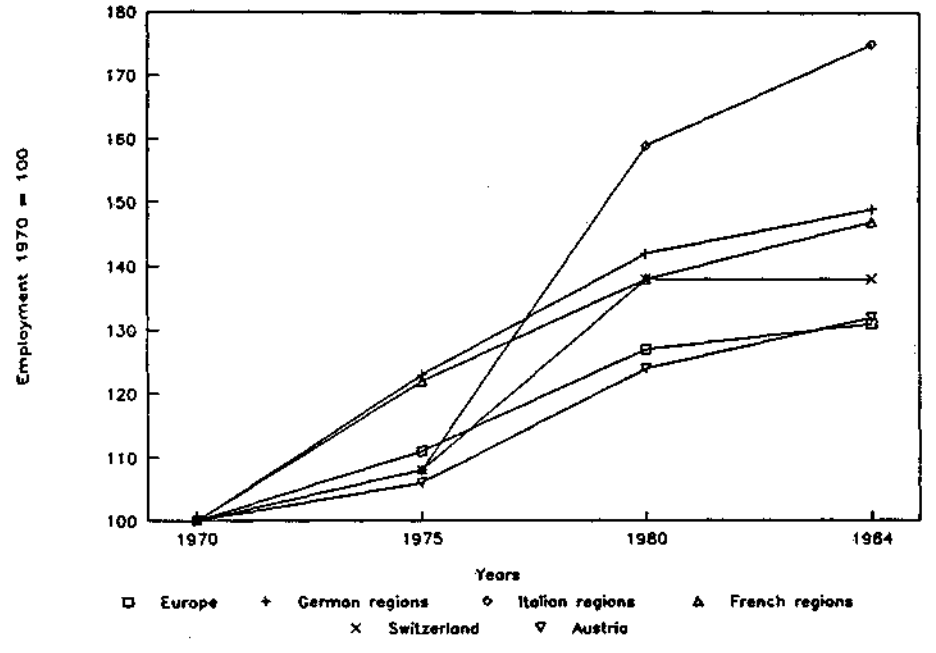


Fig. 5. Employment development on the service sector for the period 1970-1984

The service sector has become the leading sector in Europe (measured in number of jobs): Europe as a whole shows a remarkable growth in the employment in the service sector from 1970 onward. All regions concerned show an employment growth that is above European average (with Austria as a latecomer). Especially the Italian regions demonstrate a high performance in this respect.

The overall qualitative results for the three indicators used and for all regions under consideration are presented in Table 1.

	with regard to Europe		with regard to G, F or I		
	pop.	ess.	pop.	GNP	ess.
Germany	o	++			
Baden-Württemberg	+++	+++	+++	+	++
Bayern	-	++	o	++	o
Italy	o	++++			
Nord-Ovest	o	+++++	o	]---	+
Lombardia	++	+++++	++	]	++
Nord-est	--	++++	--	++	o
France	+	+			
Alsace	++	+++	o	o	+++
Franche-Comté	+	+++	o	o	+++
Rhône-Alpes	+++	+++	++	o	++
Prov. Alpes-Côte d,A.	+++++		++++	o	o
Switzerland	++	+			
Austria	--	o			

Table 1. Development of the various indicators;
GNP = Gross national product per capita
ess = Employment in the service sector
pop = Population
G = Germany, F = France, I = Italy

The qualitative information given in Table 1 forms an indication

of the economic potential of the regions. The employment in all regions is here related to the service sector, as this sector is usually regarded as the new leading sector in Europe (in subsequent sections the position of the new technology will be considered).

The results from Table 1 are interesting. For the past decades we may draw the conclusion that only the region Baden-Württemberg has a positive score in all respects. The Italian regions show however a strong growth in the service sector. Finally, the French regions considered in our analysis score in general better than their own country and run more or less parallel to Europe. Switzerland and Austria can only be compared vis-à-vis Europe; it turns out that Switzerland is performing fairly well.

Having presented now an overall picture of the socio-economic development of the European Snowbelt, the question arises what the position and contribution of the new technology sector has been. Unfortunately the data on this sector are incomplete, often inconsistent and not comparable at a European scale. Since Eurostat was unable to provide a comprehensive data set, primary and secondary data sources had to be used. Much support was provided by the various Chambers of Commerce in the regions concerned, who were very helpful in collecting and providing the data requested (see for more details Blaas, 1990). Nevertheless the current data situation precludes a systematic cross-comparative analysis of new technology developments in all regions concerned. In this respect the present study is exploratory in nature. Nevertheless, in various cases interesting data could be gathered and they have been used in subsequent sections to give a more detailed account of new technology developments in these regions and in the European Snowbelt as a whole.

In order to arrive at comparable data, the standard sectoral classification of the European Community (NACE) is used. Thus classification is also employed by Eurostat. This is a four-digit subdivision, but at the regional level only data on a two-digit classification are available. This leads of course to a less refined analysis of regional sectoral developments. Given this background, the following 6 new technology sectors have been distinguished:

a. nuclear fuels industry
b. chemical industry; man-made fibres industry
c. manufacture of office machinery and data processing machinery
d. electronics - electronical engineering
e. manufacture of other means of transport
f. instrument engineering

6. New Technology in the French Snowbelt

The French Snowbelt comprises the regions Alsace, Franch-Comté, Rhône-Alpes and Provence-Alpes-Côte d'Azur. In the presentation of the above mentioned three indicators it turned out that these regions scored above both the French and the European average. Hence it is relevant to seek for an explanation based on the new technology paradigm discussed in Sections 1-3.

For French Snowbelt regions the location quotient based on the regional employment share of each of the new technology sectors vis-à-vis the nation as a whole was calculated. The results are presented in Figure 6.

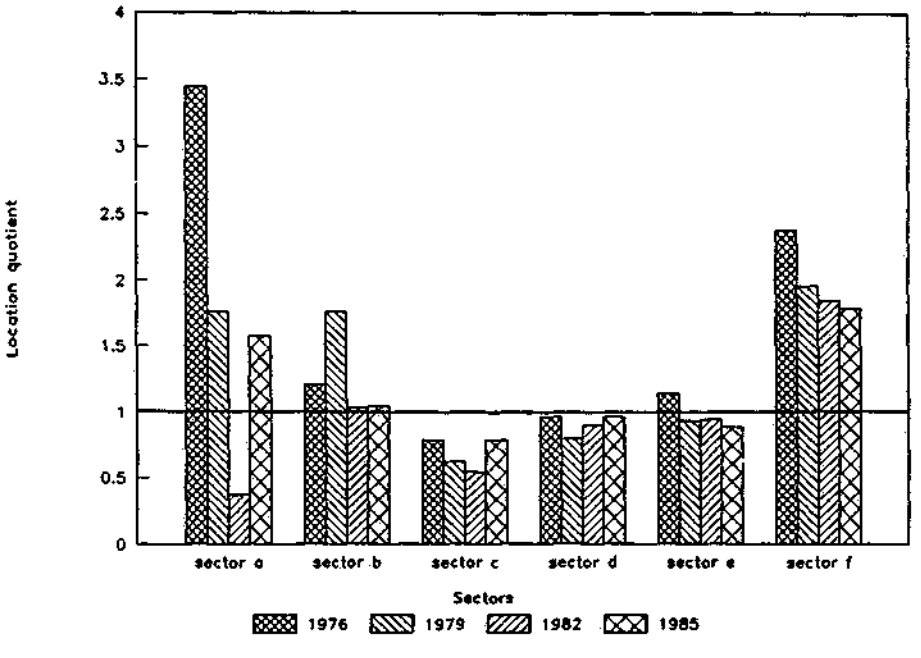


Fig. 6. Location quotients for the French Snowbelt

It turns out that during the period 1976-1985 sectors a, b and f are

intensely concentrated in the French Snowbelt, while sectors d and e are more or less equal to the French average. Only sector c (computers and information technology) is underrepresented.

A further analysis of Figure 6 brings to light that the above sectors have not grown disproportionately; on the contrary, the location quotients tend to decline during the period considered. This implies that for the French Snowbelt as a whole an increased concentration of the new technology sector has not taken place.

A more detailed investigation of location quotients at the level of the individual regions (see Blaas, 1990) indicates more variety among the four French Snowbelt regions. Provence-Alpes-Côte d'Azur is clearly attracting more activities in sectors b, d and f, while France- Comté scores relatively higher for sector d. On the other hand, Alsace does not come about as a very strong region.

7. New Technology in the German Snowbelt

The booming development of the German Snowbelt regions has also been analyzed in the same way as the French regions (see Figure 7). Unfortunately not all relevant data could be found.

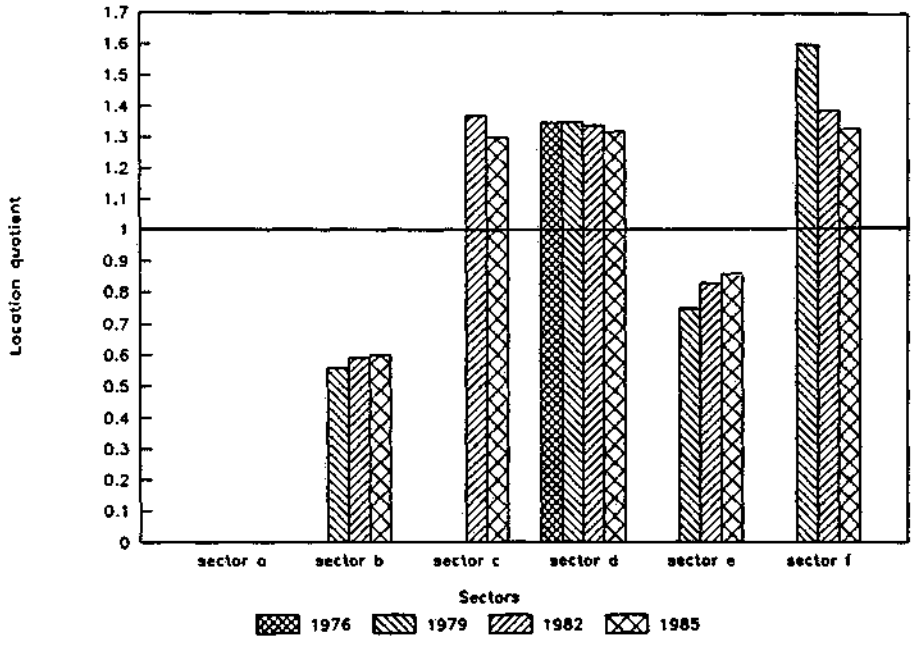


Fig. 7. Location quotients for the German Snowbelt

The picture shown by Figure 7 leads to a straightforward conclusion: the German Snowbelt regions have a concentration of sectors c, d, and f. But - analogously to the French regions - there is not an increasing concentration of new technology sectors in these German regions.

A more detailed analysis at the level of individual regions (i.e., Bayern and Baden-Württemberg) shows that Bayern is exhibiting a slight rise in the location quotient for most new technology sectors. This confirms the above mentioned 'catching up' development.

The conclusion is that the strong growth of the German Snowbelt regions is certainly not reflected in a strong growth of the location quotients for new technology sectors. Strong points of these regions are the close links between fundamental and applied research, a sound mix of multinational and specialized small and medium sized enterprises, and a well development network system among firms.

8. New Technology in the Italian Snowbelt

The regions belonging to the Italian Snowbelt exhibit a relatively strong growth in employment in the service sector. Some information on the location quotients for the six new technology sectors for the Italian Snowbelt is given in Figure 8.

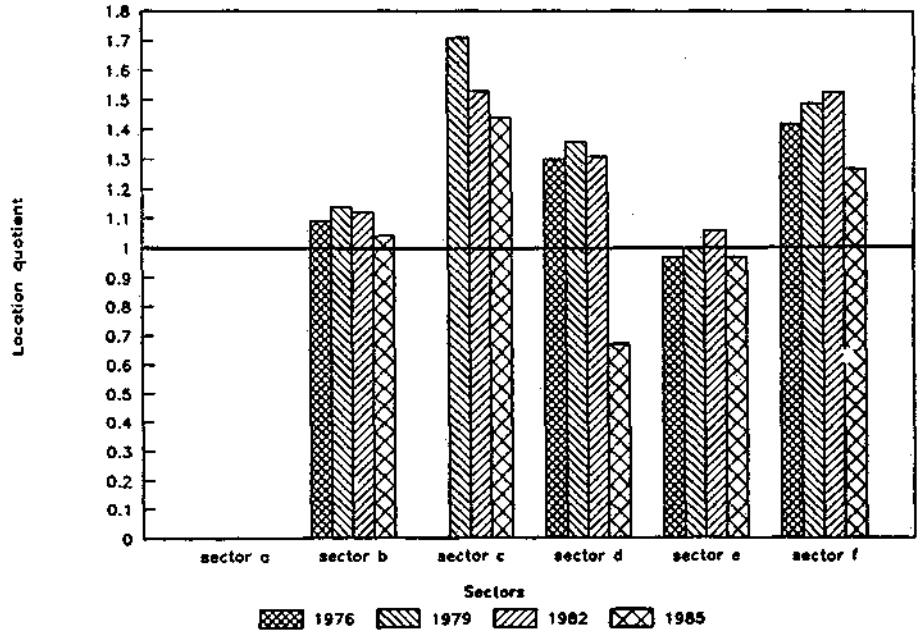


Fig. 8. Location quotients for the Italian Snowbelt

It appears that the Italian Snowbelt has for almost all new technology sectors a location quotient above 1. This is in conformity with the North-South division of the Italian economy. Figure 8 indicates however that the location quotients tend to decline, so that this suggests a slight convergence in the concentration of new technology firms over the country as a whole.

A more detailed analysis of some further available data for sub-regions leads to the conclusion that Lombardia has the far highest share of employment in the new technology sectors, except for office machines and fine-mechanical and optical instruments (which are more located in the Nord-Ovest). Data at the level of urban agglomerations obtained from Camagni an Pompili (1990) indicate that the urban centers of Torino/Genova, Milano and Venice play a dominant role in the Italian Snowbelt (with the strongest position for the Milano metropolitan area). However, a strong position of new technology sectors does not necessarily imply the highest concentration of supporting advanced services (in this respect Venice scores better), nor the highest concentration of R&D (in this respect Torino/Genova score better). Thus also in the Italian Snowbelt the pattern is less straightforward than suggested by the existing literature, although certainly various basic seedbed conditions (accessibility, adequate network structure, quality of life, trained personnel and academic research climate) are satisfied.

9. New Technology in the Austrian/Swiss Snowbelt

Unfortunately for Austria and Switzerland insufficient data at both the sectoral and the regional level were available, so that the calculation of location quotient could not be carried out. Other data (see Blaas, 1990) indicate however that R&D in Austria has stayed behind the European average, although there is at present a steady increase. Switzerland on the contrary, has a high share of R&D, comparable to the level of Sweden and the Netherlands. This explains why Austria - in contrast to Switzerland - is performing less well regarding the development of new technology sectors (see also OECD, 1989). Also the role of the Austrian government in providing incentives for high-tech research is less pronounced than in other countries.

A major problem of both Austria and (to a lesser extent) Switzerland is the relatively strong presence of old-line industries (iron and steel, petrochemical industry, wood and paper industry), for which the innovative potential is relatively low. Furthermore, Austria is hampered by the strong state intervention in large-scale traditional industries. Most of the new technology sectors in Austria are found in the Vienna agglomeration. Both Austria and Switzerland show a less well developed industrial network structure in comparison to France, Italy and Germany. In conclusion, the incubation conditions for the new technology sector have been not extremely favourable for Austria, but relatively more favourable for Switzerland. This may explain the differences between these two countries.

10. Concluding Remarks

In this exploratory paper on the regional incubator conditions of the European Snowbelt it turned out that the new technology sector played an important role in the performance of these regions (see Figures 9 and 10).

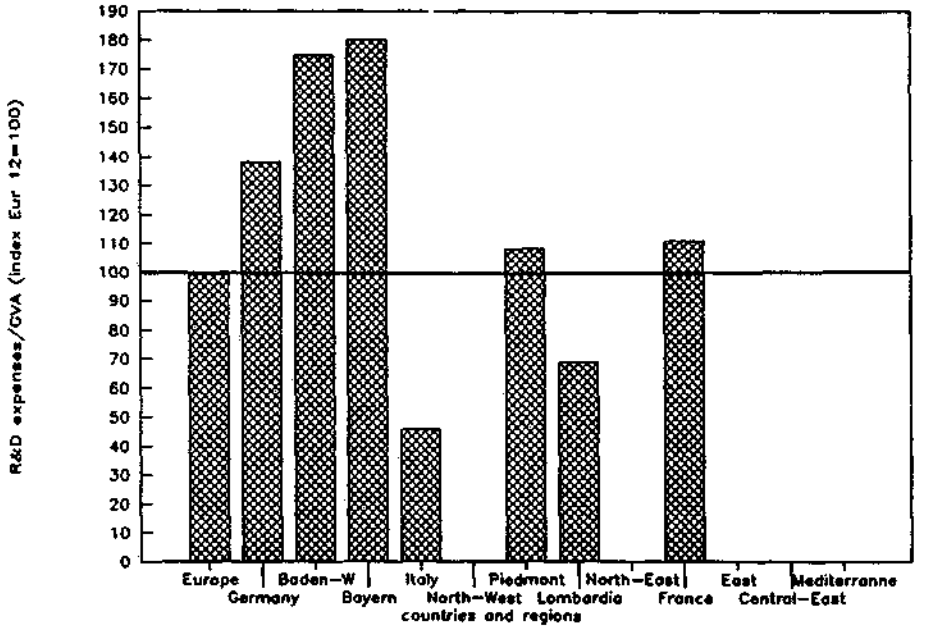


Fig. 9. Expenses private sector on R and D / Gross value added in 1983
Source: Boekhout and Romkema (1989)

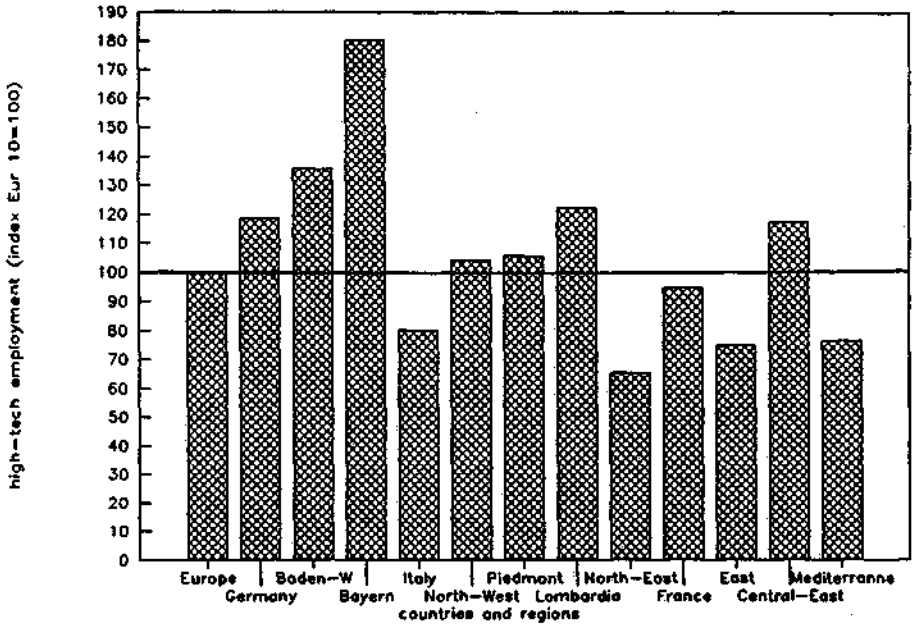


Fig. 10. High-tech employment in 1981; Eur. 10 = 100;
Source: Boekhout and Romkema (1989)

Due to lack of sufficient comparative empirical data a satisfactory test on the validity of the incubator hypothesis for the European Snowbelt could not be undertaken. However, various seedbed conditions which have proven to be valid in many other empirical studies were also fulfilled in this area. It is noteworthy that the European Snowbelt is not exhibiting a uniform economic and technological development structure. There is a great diversity among sectoral compositions, production environment and entrepreneurial spirit in these regions. Apart from being located around the Alps, there is no cohesive network structure between the regions in the different countries involved, while the reasons for having attracted new technology sectors differ drastically among those regions (witness also the difference between Bayern and Lombardia). Thus the innovative potential of the regions in the European Snowbelt seems to depend more on their geographical position in the heartland of Europe than on Neo-Schumpeterian incubation conditions. Despite the relatively higher rise in employment in the service sector, the average Gross Regional Product per capita in the Snowbelt regions does not appear to rise much faster than the national average. Most Snowbelt regions have

however developed a relatively favourable pattern of new technolo-gical activities, without too much cohesion between these activities in the different countries. In this context it is noteworthy that most of these regions have an above average share of R&D expenditures. Participation in industrial organisational network structures at a regional/national scale appeared in most regions also to be an important factor.

In conclusion, the European Snowbelt regions have a somewhat better performance than most other European regions, but their growth and new technology orientation is - with the exception of a few regions - certainly not spectacular. In this sense there is no reason to regard them as Neo-Schumpeterian regions par excellence.

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