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a case study of Polish manufacturing enterprises

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Global and local knowledge networks in innovation. A case study of Polish manufacturing enterprises.

Abstract

Ideas of learning regions and regional innovation systems and innovation networks have for long been in focus in economic geography. The importance of geographic proximity between innovating partners is widely unquestioned and documented by studies of high-tech areas in advanced countries. Not much has been said until now about the pattern of cooperation among firms in low and medium tech industry in more peripheral locations. What patterns of knowledge sourcing can be detected in such industries? The article detects the pattern and role of knowledge sourcing of such firms. It looks at the type and scale of external knowledge sourcing and the relative importance of different kinds of knowledge sources. The analysis shows that the firms are capable of sourcing knowledge flexibly and in a complex way, and that there is a division of labour between regional, global and national knowledge sources, of which global sources are considered most important to innovation, while the regional level basically provides a labour market. Firms are able to establish direct links to knowledge sources at all scales, and widely rely on ICT and their access to foreign customers. This questions the proximity hypothesis and the regional focus of industrial and regional innovation policies.

The theoretical part of the paper is rooted in a critical assessment of the ongoing debate on 'proximity' (Lorentzen, 2005). The empirical focus of the paper is a study of knowledge sourcing strategies at firm level. The empirical part of the paper is based on the analysis of interviews performed in 23 companies in two Polish cities in 2000, 2001 and 2002.

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Key words: knowledge, innovation, manufacturing, globalisation, firms, knowledge sourcing

Introduction

For nearly two decades part of economic geography has shared a focus on the region as the host of cumulative processes of growth and development, based on local cooperation and innovation. Territorialized innovation theories, or theories of localised learning, have served as a point of departure for sub-national levels of authority to engage in policies of industrial development. The fact that globalisation and the development of time and space shrinking technologies of communication and transportation has gained importance has not fundamentally changed the belief in the role of the region in economic development. This article aims at questioning some of the truisms of the territorialized innovation theories. The first part of the article questions the logic and relevance of the theories themselves. The second part of the article presents results from empirical research into the knowledge sourcing and innovation of individual companies. The results throw new light on the spatial dimension of cooperation and innovation.

Regional innovation systems and learning regions

What is it that makes localities prosper and grow? The localised learning argument has been gaining influence in economic geographic thought since Porter in 1990 launched the cluster concept. But already (Marshall 1922) suggested that small firms can gain by locating close to each other, enabling them to benefit from personal contacts and the flow of information between firms. Porter 1990 suggests the idea of industrial clusters, consisting of linkages between supporting and competing industries, demand and facilitating infrastructures, as well as enabling institutions, and competition. A cluster represents a cumulative causation for innovation, competitiveness and growth. In his later works, Porter point at the region as the locus of clusters (Porter 2003). With the concept of 'new industrial spaces' Scott & Storper 1992 suggest that collocated small firms together may achieve economies of scale as well as economies of scope. Small firms have the possibility to apply new computer based technologies to become flexible as well as dynamic, internally in the production, and externally in relation to other firms. The industrial district possesses a common pool of specialised skills, conventions, norms, values and common institutions. The group of firms will be extremely innovative and responsive to market changes.

The French innovative milieu school takes the argument to the point that the local environment is more important in competition than the individual firm (Carmagni 1991;Ache 2004). The entrepreneur and innovator is the total milieu. The internal communication is enabled by personal

relations and networks. The most important role of the milieu is its ability to search for new knowledge outside the milieu and translate it into knowledge which is understandable to the firms.

The 'innovation system' approach focuses on the systemic interaction between economic agents, companies, research institutions and the public sector (Nelson 1993; Edquist 1997) as a precondition for innovation, competitiveness and growth. Interaction among economic agents is considered a key in innovation, which explains why spatial proximity is considered advantageous. The exchange of 'tacit knowledge' is particularly dependent on close personal contact (Oerlemans, Mees, & Moekema 2000).

How close do economic agents need to be in order to exchange knowledge and change behaviour ('learn')? A group of authors argued in favour of the subnational regions and localities saying that the trust and networks arising from participation in local networks and associations facilitate the communication of tacit knowledge, and the existence of such localised networks is what explains the emergence of new and competitive regions (Braczyk, Cooke, & Heidenreich 1998; Cooke & Morgan 1998). When the process of interactive learning, is perpetuated the locality becomes a 'learning region' (Simmie 1997).

This synergy of interactive learning is dealt with by Scott (Scott 2006) in the term of 'creative field'. A creative field is the 'locationally differentiated web of production activities and associated relationships that shapes patterns of entrepreneurship and innovation in the new economy'. The creative field consists of relations and expectations among agents. The role of space in relation to the creative field is connected to its role as incubator to spin-off firms which tend to locate close to their origin to benefit from the existing networks. In spite of the fact that innovative activities increasingly reside in global connections (Scott 2006:11), Scott suggests that firms by their search for knowledge and innovative energy are induced to agglomerate in geographic space (Scott 2006:18).

Malmberg and Maskell (Malmberg & Maskell 2006) suggest two functional roles of local space in innovation. One is the role of local capabilities. The localised patterns of specialisation, the resulting local knowledge base, and the supporting forms of knowledge creation and exchange are said to be rooted in the cultural, institutional and social structures of particular places (Malmberg & Maskell 2006:3). The other is the benefits of spatial proximity between interacting parties

(Malmberg & Maskell 2006:4ff). The ability to benefit fully from information is related to spatial proximity, cognitive correspondence, and common history, identical jurisdictional order, and equivalent factor costs (Bathelt, Malmberg, & Maskell 2004; Malmberg & Maskell 2006:5).

In sum the territorialized innovation theories share the assumption that linkages between persons, firms and institutions containing information and knowledge flows is basic to the innovation and development of firms and territories in the new economy. The flows can be societal (staff turn over, spin-off firms) or personal (meetings, chats, projects), and they are most likely to take place, if the collaborating agents share history and values. It is, however, not clear *how close* the agents need to be to make knowledge exchange work, and the contributions do not define what is meant by 'region' 'industrial district' or 'milieu' in terms of spatial extension and inclusion of agents¹.

The global and the local

Globalisation is a process by which economic activity is expanded across national boundaries, and more importantly the functional integration of internationally dispersed activities (Dicken 2003). It involves the intensification of worldwide social relations, and links events in widely separated places. It is connected with the advances of information- and communication technologies, with liberalisation policies and with the establishment of supranational institutions. From a perspective of interaction and learning this process should have considerable spatial consequences, and some recent contributions discuss specifically the role of the local and the global in innovation and learning.

Many contributions argue like Cooke, Uranga, & Extbarria 1997 that globalisation is followed by a *strengthening* of the role of the region, where there is an increased need for close cooperation among regional actors, regional universities, industry associations and technology transfer organisations. Malmberg & Maskell 2006 claim that localised learning has become even more important due to the quest for specialisation advantages. The particular role of the local is due to the functional difference between the local and the global connections, proposed by Storper & Venables 2002. Knowledge is embedded in the local environment and diffused spontaneously through 'local buzz'. In order to benefit from local buzz one has to be present, to meet and chat in organised and unorganised meetings. Malmberg & Maskell 2006 suggest that spatial proximity helps firms identify and imitate superior solutions while combining them with ideas of their own – almost

without effort or cost. However if firms rely exclusively on the local knowledge base, they run a risk of technological lock-in. Knowledge sourcing from non-local sources is too much for most firms. It has to be organised in networks or partnerships. This is the '*global pipeline*'. Compared to local knowledge exchange, the non- local knowledge sourcing is costly and takes time.

Sternberg 2000 stresses that the integration into international and global networks play an essential role in the continual renewal of regional networks. But without the regional network small firms would not have access to global knowledge resources. In his empirical research however, Sternberg finds the national network of most importance to the investigated firms.

Some authors substitute 'region' with 'city' or urban space in their discussion. Simmie 2003 suggests that firms locate in large urban agglomerations because of the pool of technical knowledge existing in the urban space. However firms will need to do extra-regional knowledge sourcing as well, because the local sources are not enough. An empirical investigation suggests that the most innovative firms in the sample used more external sources than the less innovative firms did. Based on his observations, Simmie suggests the idea of innovative regions as nodes and gateways for the exchange and trading of ideas. The most open, trading regions will gain competitive advantage because they will be the first to receive new knowledge, as well as a larger amount of knowledge, compared to other regions. Also Scott & Storper 2003 see regions as sources of positive externalities like information flows, craft and design traditions etc. freely available to local firms. The big city regions are even locomotives of the national economy. They compete with other regions and are linked together via long distance commodity chains. More peripheral areas are linked to the big agglomerations via commodity chains.

While the mentioned contributions see the regional level as a mediator between the firm and the global knowledge sources, Rutten 2003 takes his point of departure is the individual firm. He suggests that 1) different tasks are accomplished by individual firms in different spatial networks, from the local to the global and that 2) the spatiality of the network depends on the phase of innovation. Thus basic research is performed on a global scale. New concept development is done on a local scale. Engineering is performed in collaboration with suppliers on a regional scale, and production takes place on a global scale. This perspective is in comparison more complex and dynamic.

Summing up the introduction of the global in the territorial innovation theories has not resulted in a change of the basic argument, that location in a particular region or city context is very important to innovation and competitive strength. The global is a necessary, but difficult source of knowledge, which firms need help from the region to approach. It is suggested that the crucial phase of development and engineering still rests within local and regional networks, even though other phases may rest in global networks.

Strangely enough the contribution do not consider the role of global linkages among firms and the globalisation of knowledge and culture, and the idea of a mediator between individual firms and the global seems a little mysterious and is not very well argued.

Proximity and innovation

The assumed need for firms to be close to other firms is used to explain the territorial grouping of firms on certain locations. The notion of proximity takes us closer to the prime agent of innovation, the firm. The territorialized innovation theories boil down to the idea that proximity among economic agents is important to innovation. Two assumptions underlie this idea. One is that interaction is a precondition for innovation and another is that cooperation is better, the closer the actors are to each other. Assuming that the first idea has a hold in reality, the question therefore is, what 'close' means.

Geographic proximity expresses the kilometric distance that separates two units in geographic space. To economic actors intending to interact it is relative in terms of cost and time, and may represent a constraint (Torre & Rallet 2005). The relativity of the geographic proximity means that it changes along with the advance in time and space compressing technologies. Today, therefore, the importance of kilometric distance as such is diminishing as a constraint to human interaction. There are also other proximities to consider, however. *Organised* proximity is the ability of an organisation to make its members interact. The interactions are facilitated by rules and routines of behaviour that they follow. Organised proximity can exist without spatial proximity, as organisations may exist at all spatial scales (Torre & Rallet 2005:51). The need for co-location is therefore less than the territorialized innovation theories assume. This is due to the increased mobility of men, information and goods, and to new ways of working by travelling (experts, salesmen, researchers). If geographic proximity is needed on some point in the cooperation, short visits may suffice to share knowledge or solve problems. This is what Torre and Rallet call *temporary* proximity. This can be supplemented by '*virtual*' proximity, which is made possible by

the development of ICT technologies, which enable the sharing of even tacit knowledge over long distances through different forms of representation (Foray & Steinmueller 2003).

While Torre and Rallay discuss proximity in time and space, Boschma 2005 discusses some qualitative dimensions of proximity. Boschma 2005 suggests cognitive, organisational, social, institutional proximities which are explained in much detail, as supplementary to geographic proximity. According to Boschma, the proximities influence each other, supplement each other and substitute for each other. For example can organisational proximity substitute social or geographic organisational proximities. In spite of the qualitative character of the suggested proximities, Boschma treats them quantitatively. The proximities can be measured and added in doses as a solution to situations of low interactive learning and technological lock-in. If not taken too literally, his suggested scheme may inspire improvements of cooperation of any kind. However, it is difficult to find any particular logic in the suggested proximities, and the list could be even longer. Focussing on innovation why not talk about for example technological, professional or economic proximity between agents?

The new development of the notion of proximity is a way to allow non-local interaction in the theory of innovation. New technology redefines time and space and brings actors within reach of each, temporarily or virtually. The main thing is that they understand each other. It is thus the discussion of proximity, more than the discussion of globalisation, that more profoundly opens the territorialized innovation theories to the influence of globalisation.

A change of focus towards knowledge sourcing

Empirical evidence of learning regions is more than scarce (MacKinnon, Cumbers, & Chapman 2002; Moulart & Seika 2003), and research has focused on high-tech fields of industry, like Silicon Valley, where labour turn over and professional networks among computer scientists have anchored the companies in the region and knitted the companies together in networks (Saxenian 1994).

Additional perspectives as well as alternative approaches might enhance our knowledge about what makes firms and regions innovative and prosperous.

Accepting the assumption shared by the territorialized innovation theories that firms need to supply their internal knowledge base with knowledge from outside the company a research approach focusing on the choices and strategies of knowledge sourcing of *individual firms* seems justified. Further, research into branches of industry other than high-tech branches would be helpful when

trying to detect the sources of innovation accessible to less fortunate regions. After all most regions have to live from other activities than high tech. Based on the theoretical discussion the following questions for research arise:

What type of knowledge is the most needed by the firms? How can the external sources of knowledge be characterised? What is the location, or scale of the knowledge sources? What is the role of the region, or local area, to the knowledge sourcing of the companies? Is there a difference in the role of the global, local and national scales in the knowledge sourcing of the companies? Do the companies for example use a local or regional mediator between themselves and the global knowledge sources? How is globalisation reflected in the knowledge sourcing of the companies? Does ICT make a difference in the knowledge sourcing of the companies? What does travelling mean to the knowledge sourcing of the companies?

Methodology

Research into these questions has been conducted through a case study of innovation strategies in Polish manufacturing companies. The study is an enterprise level study in two city regions of Poland. The collection of data took place in 2000, 2001 and 2002 and dealt with many issues related to the innovation strategies of the firms. The data collection technique consisted of open-ended interviews with representatives from management. The companies represented different branches of manufacturing industry, and they were selected with the help from local business support organisations. The companies were typical for post-communist Poland, but it was not intended to reach statistical representativity. 28 companies gave interviews, and 23 of the interviews were selected for the present analysis. The research was basically qualitative. It was explorative within the framework of key concepts related to innovation. Being semi-structured, the data allowed a certain degree of quantification. The simple statistical analysis revealed some interesting patterns which question the basics of territorial innovation theory.

Presentation of sample

The sample consists of 23 companies located in and around two major Polish towns, Krakow and Wroclaw. 10 of the companies are from Krakow and 13 from Wroclaw. They are manufacturing companies, belonging to different branches of industry. The branches are food, plastic and rubber, glass, metal mechanical, machine building, instruments, electronics and pharmaceuticals. Together

the companies represent an employment of 3,750 persons. The largest company employed 1,000 persons, the smallest only 5 people. 19 or 82% of the companies have less than 250 employees .ⁱⁱ

All the companies in the sample are private companies, except for one which is owned by the Polish state. Most of the companies have Polish owners (18 companies, or 78%). 3 of the companies are foreign owned, by Dutch, German and American investors respectively. One company is a joint venture between Polish and Swiss capital. Among the 23 companies 4 of them are former state owned companies which have been privatised. The other companies have been founded as private companies.

The founding year of the companies reach from 1920 to 1998, and the sample represents most of the industrialisation history of Poland (see table 1).

Table 1. Founding year of the companies, no of companies and percentages		
Founding year	No of companies	<i>Percentage of companies</i>
1900-1945	2	9
1946-1980	1	4
1981-1989	7	30
1990 -	13	57
Total	23	100

Two companies were founded during the first wave of industrialisation in Poland in the beginning of the century. Four of the companies date from the communist times. Only one of them exists today as state-owned company. The three other companies from communist times were restructured into private companies during the nineties, and thus legally founded in this decade. Seven of the companies date from the decade of reform in the 1980s. After the demise of communism in late 1989 many private companies were founded. 13 of the companies of the sample belong to this period.

Type of innovation introduced by the companies

In the interviews the companies told about their innovative activities, and they were asked specifically about the innovations they had introduced in the company during the last two-three years. The answers are summarized in table 2.

The companies of the sample are all innovative. Many of them were founded by people who wanted to realise new ideas. Three of the companies were spin-off companies from one of the local the universities, where professors have wanted to realize the economic potentials of their research.

Table 2. Type of innovation in the companies, no of companies and percentages			
	No of companies	percentage	
Product innovation	22	96	
Process innovation	19	83	
Both product and process innovation	17	74	
Organisation change	8	35	
Product, process and organisation	5	22	
New materials	4	17	
Other	2	9	

All companies were innovating their *products*, although one of them had not made any changes during the most recent period. The companies were continuously developing the design and quality of their products, or developing new applications for them. After some initial radical innovation, it was most common to do *incremental* product innovations inspired by customers and market opportunities.

A large majority of the companies innovated their *production process*. The companies had invested in new machines. They upgraded their production process by substituting manual processes by mechanical processes and semiautomatic process by automatic processes. Still, many of the companies found it difficult to close the technological gap between their own company and the foreign competitors, due to limited financial funds. Three quarters of the companies were innovating both their products and their production processes.

Organisational innovation was not so common among the companies. Only a third of the companies had worked on organisational innovation recently. Changes in organisation were mainly due to the demands of certification. Only a fifth of the companies innovated all three dimensions,

product, process and organisational innovation. In sum all the companies were innovative, with a focus on product innovation, but process innovation also played an important part in the effort of the companies to compete.

The rest of the paper is dedicated to the patterns of external knowledge sourcing found with the companies. It draws a picture of the knowledge source, their spatial scales and relative importance. It looks into the fields of knowledge most in demand, and to the role of stable and personal networks. Finally it wraps up by investigating possible barriers to external knowledge sources.

External knowledge sources

The interviews show that external knowledge sourcing is part of the routine in all the companies of the sample. External knowledge sourcing is considered as natural an activity as the purchase of inputs of other kinds. As one of the interviewees said:

‘Business is first of all exchange of information!’ (19:16).

Table 3. External knowledge source. No of companies and <i>percentage</i>								
	Customers	suppliers	reruitment	training	Inst.	meetings	media	In house R&D
No of comp.	20	13	8	14	14	12	19	15
% of comp.	87%	57%	35%	61%	61%	52%	83%	65%

As it can be seen from table 3 *customers*, closely followed by *media* are the most *frequently* mentioned external knowledge sources. Customers are used by 20 of 23, or 87% of the companies. *Media*, particularly the internet and magazines, is mentioned by 83% (19 companies). *Training of staff* brings new knowledge to 61% of the companies (or 14 companies). Organisations of the business support system, and universities provide 61% of the companies with knowledge. *Suppliers* supply a good half of the companies (57%) with knowledge. Half of the companies get knowledge from meetings, fairs and conferences. Recruitment is considered necessary in a third of the companies (35%). In their search strategy all companies combine different knowledge sources. As one interviewee said:

‘[We use] all the standard sources of information. The Internet, some meetings, meetings with customers, because they also pass on some information that they have seen something somewhere. The competitor has some new stuff, so then we know, and we can get the information what it is and is it the same as we have or something new. We also get a lot of research that the other companies are sending to us, you know brochures, some information’ (8:15).

The customers may bring knowledge as well as ideas for innovation:

‘Often the customer needs something that we really do not produce, but then the company look for information and introduces it’ (6:16).

The external knowledge sourcing activities in general must be seen in the perspective of the *in house research and development activities*. As many as 65% of the companies mention in house research and development. It is considered very important for the innovation in the companies. External knowledge sourcing does not generally substitute in-house R&D. It rather inspires and supplements it.

The spatial scale of external knowledge sources

These external knowledge sources are located in geographic space. Some belong to the regional locality, some further away in the national context, and some are located abroad in foreign countries. The question which this section will focus on is to what extent the companies draw on the regional, national and global scales in their knowledge sourcing and secondly, whether there is a spatial pattern in the knowledge source used by the companies.

The analysis of the data suggests that the companies use knowledge sources on all three scales, the regional, national and global scale (table 4). Most companies use knowledge sources on all three scales, and *all* companies use knowledge sources *on the global scale*. The analysis of the data further suggests that there is a *spatial pattern* in the knowledge sourcing of the companies.

Table 4. Scale of external knowledge source. No of companies and percentages.								
	Customers	Suppliers	Reruitment	Training	Instit	Meetings	Patents	Media
No of companies								
Regional	2	0	8	8	8	4	0	0
National	13	4	1	3	6	7	0	0
Global	14	10	0	3	0	10	0	19
National and global	8	1	0	0	0	6	0	0
Regional and national	1	0	0	0	0	1	0	0
% of companies								
<i>Regional</i>	<i>8.6</i>	<i>0</i>	<i>35</i>	<i>35</i>	<i>35</i>	<i>17</i>	<i>0</i>	<i>0</i>
<i>National</i>	<i>57</i>	<i>17</i>	<i>4</i>	<i>13</i>	<i>26</i>	<i>30</i>	<i>0</i>	<i>0</i>
<i>Global</i>	<i>61</i>	<i>43</i>	<i>0</i>	<i>13</i>	<i>0</i>	<i>43</i>	<i>0</i>	<i>83</i>
<i>National and global</i>	<i>35</i>	<i>4</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>26</i>	<i>0</i>	<i>0</i>
<i>Regional and national</i>	<i>4</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>4</i>	<i>0</i>	<i>0</i>

The *regional* level provides the companies with *training* from training institutions and information and knowledge from the regionally situated *business support system* and *universities*. National level institutions are also used by some of the companies, but more companies use regional level institutions and training (35% and 35% respectively). The use of regional institutions is for example like this:

‘We are cooperating with the Word Trade Centre in Wroclaw. You know the Wroclaw Institute of Technology Transfer, and we have information from our embassies in other countries. We have many connections’ (15:17).

Recruitment is another thing that the regional level provides. The companies recruit labour as well as specialists in the regional and local environment, and none of the companies complained that the local labour market could not provide them with sufficient qualificationsⁱⁱⁱ. One interviewee expressed it like this:

‘Krakow is the best place, because we have about 20 high schools, so it is not a problem. We have a project and I am hiring an engineer only for that project. It is very often’ (8:15).

At the *global* level the sources of knowledge are various. *Media*, as the internet and international magazines are used by most companies (19 companies or 83%). *Customers* and *suppliers* abroad represent important knowledge sources as well, and are mentioned by 61% and 43% of the companies. Finally many companies participate in international *meetings*, like fairs and conferences.

An interviewee tells about his use of media and meetings:

‘I look on the Internet for a lot of information, I have got even over here, special magazines. I watch what is going on. I have a lot of booklets, we take part in fairs, we make some contacts and look around, what is going on’ (9:17).

Another reports about his use of institutions at all scales:

‘We have cooperation with different research institutes in Poland, in Krakow polytechnical institute, the XX institute in Warsaw, in XX institute in Malaysia, we have information about new ideas and new methods, and we try something [new]’ (19:9).

Some get a lot out of their global suppliers:

‘In our branch there are not many companies which produce it. It is only, I do not know, ten all over the world, and if they have something new they send it to us immediately, it is their business. If they want to sell it only we can buy it and the second possibility is that we can see something new in our competitors and we look for something similar, for example, where and how’ (19:14).

International fairs are very important as source of knowledge:

‘We are joining fairs, international fairs like Munich, Brussels, also Russian, Minsk, Moscow. We are going abroad to join the fairs and we are watching, observing. And in most cases we are going to Italy, because Italy is the source of production, the biggest market of XX-making (2:11)

The *national* level is less important compared to the regional and the global levels. There is not even one aspect in which the national level is more important than either the regional or the global level as the scale where companies practice their knowledge sourcing. Most important on the national level are *customers*, *meetings* and the *national institutions* as providers of knowledge. Many firms (35%) use both national and foreign customers as sources of knowledge. A couple of firms (26%) also participate in both national and international fairs and conferences.

The analysis shows that there is a discernible pattern in relation to the scale of knowledge sources used. There is practically no coincidence between the type of knowledge sources used at the regional level on the one hand and those used at national and global levels on the other hand. This suggests a relatively clear *division of labour* between the regional level and the national (and the global) levels. The roles of the global and the national levels are more blurred, however leaving no doubt of *a significant role of the global level*.

While table 3 and 4 summarise the frequency with which knowledge sources are mentioned by the companies it does not say anything about the importance attached to the knowledge sources by the companies. Asked about the relative importance of the knowledge sources, the companies point at *customers*. When asked about the most important scale of knowledge sourcing, the companies point at the *global scale*. NO source is seen as more important than *customers abroad*.

As one interviewee said about the role of global customer

‘[We communicate with our customers] about offers, about new shapes, about new ways, about new products. I mean in this case we are sending regularly some new products for the showrooms by different trade centres in Western Europe....Let us say in Denmark the blue colour is not so popular as in Germany; and in France orange, yellow and such strong colours are very popular, so you see, I must discuss everything with the local partner, because...I would not know what to launch, what to produce. For every country we have different offers’ (3:12-13).

Fields of knowledge achieved from external sources

Many types of knowledge are necessary to run a company and to innovate. Technical, artistic, economic and organisational knowledge is combined in the operation and the innovation in a company. What field of knowledge do the companies particularly seek in when sourcing supplementary knowledge for their innovations? Table 5 summarises the answers of the companies in relation the field of knowledge that is being sought from external sources.

Field of knowledge	No of companies	% of companies
Products	20	87
Markets	13	57
Methods	11	48
Materials	6	26
Organisation	6	26
Financing	6	26
Basic research	1	4

As it can be seen from table 5, knowledge related to *products* is the most frequent type of knowledge sought by the companies. 87% of the companies look for such knowledge outside of the company. The companies that do not search for product ideas from outside find the source of innovation in their own research and development. The search product related information may take place like this:

‘There are two ways. There is market research and there are also presentations of products and talking directly to clients, taking their view of the products. Through these presentations we try to collect information on new products that are being introduced’ (20:14).

The search for knowledge about *markets* comes second. 57% of the companies tell how they follow the development of competing products, the development of the demand for their type of products, the changing needs of the customers, and the scope for new markets in new regions or new segments of customers.

‘We do a lot of market analysis, so we can know our weaknesses and our advantages (2:11)

Third in priority stands knowledge about *production methods*. Such knowledge is needed in connection with the planning of new investment or in relation to the introduction of new equipment.

‘We are analyzing our production. We are comparing ourselves to other companies; we try to analyse the way they produce things and developments that we could apply in our company’ (2:11).

Other types of knowledge that the companies might look for is related to *materials*, as for example the substitution of leather or metal with synthetic materials, or the development of the layers of microchips. Externally obtained knowledge may concern the development of the *organisation* as for example in connection with the introduction of quality certification or other new management practices. Finally an issue like *financing* is a matter of concern, where information is needed from outside the company about the possibilities to obtain special loans or subsidies. Each of these three issues, materials, organisation and financing, were mentioned by 26% of the companies.

Only one company told about the need for knowledge from outside about the advances of *basic research*. This company was a research institution in itself, and a global leader in its field.

Most of the companies searched for several types of knowledge simultaneously. Most of them focussed on products as well as markets, and more than half (52%) of the companies looked for 3 different types of knowledge or more. In sum *products* and *markets* were top issues in the knowledge search of the companies.

Networking

External knowledge sourcing on all spatial scales is thus part of the activities. How do the companies govern their search? Do they shop around or do they work within stable networks? Do the companies maintain personal contacts or do they use impersonal sources of knowledge?

The analysis shows that most companies maintain the contact with knowledge sources on a *regular basis* (61%). Further the investigation showed that more than half of the companies mentioned that their most important knowledge sources were *personal* contacts, with which they maintained permanent relations. This means that they worked in *networks*. It does not mean, however that they

exclusively rely on these networks nor that the networks are local. The companies flexibly addressed different types and scales of knowledge sources, depending on their need.

A company works with personal networks like this:

‘We have contacts to companies and people, who, but that is individual persons, that is no firm that for example want to cooperate. My people know that, and one is for example an automation specialist, another is specialist in galvano technique. They are not linked with each other. We talk with everybody, we have these and these problems, how can we solve them? They are not locals. They are people in Poland. In Schlesien a man who knows galvano technique, in Wroclaw an automation specialist’ (12:17).

Barriers for access to knowledge

If knowledge is crucial to innovation, lack of access to knowledge sources would threaten innovation and competitiveness. Particularly companies located in peripheral regions could be expected to face barriers to the access to knowledge. This is the rationale behind the work of the business support system. Therefore part of the interviews aimed at detecting possible barriers in the access to knowledge. Table 6 summarises the answers.

Table 6. Barriers for access to knowledge, no of companies and percentages						
	No barriers	No money	No access to technical knowledge	Too much information	Bureaucracy	No comments
No. of companies	7	7	2	1	1	5
% of companies	30	30	9	4	4	22

As it can be seen from this table, the companies of the sample really *do not see any barriers to the access to knowledge*. Some of them were quite surprised of the question and saw no problem at all (30%) and one company claimed that they got more information than they could handle. Some companies (30%) pointed at the fact that their only problem was money to realise their ideas. When asked about what the authorities could possible do to help them, they talked about the general economic climate and about taxes. Nobody talked about developing the business support system.

This means that barriers related to knowledge sourcing, are to be found in the economy and capability of the company. As an interviewee told me:

‘Often we have even too much information. You cannot concentrate on other things. There is so much information that it is practically difficult to get something important out of it.’ (6:17).

Summary of findings

The research presented in this article sheds light on innovation and knowledge sourcing strategies of low and medium tech manufacturing companies. The companies all shared a focus on innovation, mostly on product innovation, but they also continuously upgraded their production process. They continuously worked on design and quality, new applications. As basis of their innovation the companies most often relied on their in-house R&D, but the innovation of the companies was developed in a dialogue with the environment, from where the companies sourced different sorts of knowledge. Most often the companies sought knowledge about *products* and *markets* in order to direct their product innovation and find new markets.

External knowledge sourcing and knowledge exchange was an important part of the activity of the companies. All companies combined different external sources of knowledge, but *customers and media* were the most frequently used knowledge sources. The companies combined knowledge sourcing on *regional, national as well as global scale*, and literally *all* companies used knowledge sources on *the global scale*.

The three scales played different functional roles in the knowledge sourcing of the companies. The *regional scale* fulfilled the role of *recruitment and training*. The regional *business support system* was used by some, and some companies had cooperation with colleagues on local *universities*. On the *global level* the companies used *media as the internet, professional magazines and journals*. They had direct contact with *foreign customers and suppliers*. Also international *fairs and meetings* were important as sources of knowledge. Of all knowledge sources the companies assessed *customers abroad* most important for their innovation. On the *national level* the companies used *customers, meetings and national institutions*, but the global level was on all points used more frequently than the national level.

The analysis thus indicates a functional *division of labour* between the different scales of knowledge sources where the role of the regional scale is quite different from the roles of the national and global scales.

Some companies have stable network relations with specialists, customers or investors, but contacts are neither particularly local nor considered very important to the innovation of the companies. In general the companies felt *no barriers* prohibiting the access to external knowledge sources. Knowledge abounded, and problems, if any, were seen in relation to the time it took to handle it, and the resources needed to implement ideas as innovation. Not institution building, but a better macro-economic climate was on the list of wishes.

Theoretical perspectives

The research here deals with knowledge sourcing strategies of individual firms in medium and low tech industry. The companies proved to be quite innovative and very keen on sourcing knowledge from outside as an input to this innovation. Their map of knowledge sources was quite complex, and their use of the sources was flexible. Knowledge sources were in fact addressed on all spatial scales, and it is notable that there seemed to be a division of labour between the knowledge sources on the different scales. The role of the *regional scale* was to provide a basis for recruitment of labour and specialists, and institutions for training. The regional level represents a kind of ‘infrastructure’ for innovation. The *global* and to a minor degree the national scales, provide important knowledge from customers and markets which is used directly in relation to product and process innovation.

The companies handled their knowledge sourcing on all spatial scales without interference or mediation from any networks or institutions, whether the source was personal, printed or virtual. On some points companies maintained of a ‘task network’ of experts.

Globalisation was reflected very clearly in the knowledge sourcing of the companies. The companies were part of the *globalisation of trade and knowledge flows*, as particularly foreign customers but also foreign suppliers and foreign investors were important as providers of knowledge. The development of *computer technology* had turned the Internet into a very important tool in the daily knowledge search. The companies looked for many types of information from market changes to research results. The Internet was also used interactively to discuss with customers about product development. The internet thus supported the globalisation of knowledge flows, and enabled the exchange of less tangible knowledge. The increased mobility combined with the existence of global companies and institutions made staff members travel regularly to fairs and meetings to exchange knowledge.

In the perspective of 'proximity' dimensions, the relationship between the firms and their sources can be characterised as professional and technological, virtual as well as temporary. Spatial and permanent proximity was not a dominating characteristic of these relations. It is a question if 'proximity' is a helpful notion in relation to knowledge sourcing today. A better way to term the relationships between companies and their knowledge sources could be 'embeddedness' of agent of innovation. It can be suggested that social and economic agents of innovation may exchange relevant information and share knowledge if they are embedded in the same professional and technological society, and share some goals and rules of the game. Global institutions and organisations as well as information, communication and transportation technologies facilitate the communication among such agents over long distances.

Why did the companies not find important knowledge sources in their close vicinity, as the territorialized innovation theories suggest they would? First because customers are the most important source and customers are no longer local. Second because competition is global and so benchmarking and knowledge sourcing has to be global as well. Third because of the specialisation of production, which implies a specialisation of knowledge. Local institutions do generally not provide such knowledge.

This research therefore does not support the idea of the territorialized innovation theories that regional partners and institutions are particularly important in innovation, neither that there is a need for mediation between the firms and the global knowledge sources. The role of the region is mainly to provide education and labour.

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ⁱ The notion of the 'region' in human geography is seldom clearly defined. Following Paasi 2002, it is important to distinguish between 'place' and 'region'. Place is understood contextually in relation to ethnicity, class, gender, identity and so on, and denotes the location of these social relations. Region, on the other hand is a space of action and publicity, a constructed institutional structure. This implies that 'industrial spaces' or 'learning regions' would represent spaces of economic interaction and agency at different spatial scales.

ⁱⁱ The most usual definition of small and medium sized enterprises in terms of staff is up to 250 employees, see Ayyagari, Beck, & Demirgüç-Kunt 2005; European Commission 2005.

ⁱⁱⁱ The role of the regional level in relation to recruitment is due to the big offer of universities and training institutions education in the selected regions.