Regional Innovation System in the Pomeranian Province of Poland

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ABSTRACT.[1]

The concept of an innovation system stresses the role of interaction and co-operation between different agents creating and distributing knowledge and innovation. In the post-communist countries like Poland, most of the institutions similar to those of mature market economies are already established. However they not yet embedded in the economy. That is one of the reasons why co-operation between agents in the Polish innovation system is very weak, which results in a very low level of innovation throughout the entire economy.

In 2001, The Gdansk Institute for Market Economy undertook research into the regional innovation system of one of the Polish regions – the Pomeranian Region. The results of the research showed that the majority of firms in the region do not co-operate in the innovation process, especially on the regional level. Horizontal linkages between firms almost do not exist. Firms perceive other firms mainly as competitors and are afraid of co-operation. They believe co-operation leads to the theft of their ideas and precious workers. If co-operation occurs, it concerns only less risky and costly phases of the innovation process like joint development, joint conferences and exhibitions as well as joint marketing strategy.

The Pomeranian firms also have very weak linkages to the public scientific sector. They very rarely co-operate with scientific research institutions or technology transfer institutions. The weak interaction between firms, both among themselves and with those in academia, results in a very low overall and especially business R&D expenditure. The Pomeranian region, similar to the entire country, is mainly a user, not a producer of technology. The majority of the firms' capital is imported from foreign countries. To sustain the long-run competitiveness of industry it is crucial to enhance the R&D activity of Polish firms, preferably basing this on co-operation with other agents of the innovation system. A policy stimulating interactions in the innovation process could be cheaper than a policy establishing new institutions as co-operation steers resources into a single effort and it has multiple effects.

An important source of new knowledge might be the exchange of information and ideas during conferences, exhibitions, co-operation of firms in chambers of commerce, etc. However, the majority of Pomeranian firms belong to different firms' associations on the domestic level. As co-operation on the regional level might be more effective, regional authorities should induce dialogue between firms and other regional agents.

In the Strategy of Development of the Region originating in the year 2000, one of the main priorities is building an effective regional innovation system. However, it is important that all the actions undertaken are based on their usefulness for enterprises, which are the most important agents in the RIS.

[1] The authors would like to thank Cathrine Lockhead-Strzepka from The Institute of Economy at The Rzeszów University of Information Technology and Management for corrections to the English translation

Introduction

The concept of an innovation system stresses the role of interaction and co-operation between various agents such as companies, public research and development (R&D) institutions including universities, scientific institutes and public and private bridging institutions (technology transfer centres, knowledge intensive business services etc.). These organizations create and distribute knowledge and innovation In the post-communist countries like Poland, most of the institutions found in mature market economies are already established. However, they are not yet embedded in the economy. That is one of the reasons why co-operation between agents of innovation system in Poland is very weak, which results in a very low level of innovation throughout the entire economy.

In 2001, the Gdansk Institute for Market Economics undertook research into the regional innovation system of one Polish region – the Pomeranian Region. The research was based on a questionnaire for businesses. Undertaking of this research was crucial from the perspective of the low level of innovation throughout the Polish economy. Gross Domestic Expenditure on R&D in Poland constitutes about 0.75% of GDP (1998) while in the EU this figure averages 1.81%, in Japan.3.04%, and in the USA 2.65%. As the Polish GDP is much lower than the GDP of the above countries, absolute spending in Poland is much lower: about 64 USD per capita while in the EU it is 385 USD, in Japan 733 USD and in the USA 893 USD per capita per year. Moreover, the majority of R&D expenditure is financed by the government: in the Pomeranian region only 26.1% of R&D expenditure comes from economic agents – in all of Poland it is 30.6%. It means that the government finances nearly 70% of R&D in Poland. This reflects the weakness of the Polish enterprises and their lack of interest in innovation. In the most developed countries, R&D is initiated and sponsored mainly by business (in the EU almost 55% of all R&D is conducted in this way, while in the USA about 67% and in Japan almost 73%). Even in high technology industries the intensity of R&D in Poland is much lower than in the majority of other OECD countries: in 1999 R&D expenditures constituted about 5.1% of the revenues of high technology industries in Poland while in Japan it was 11.3%, in the USA 27.3% and in the EU leaders like France 27.8%, Italy 21.8% and Germany 19.5%.[2] This low level of innovation activity in the Polish economy creates threats to the future economic development of the country: there is empirical evidence that R&D expenditure lower than 1% of GDP causes innovation and technological development to wither. For technological progress to occur, the R&D expenditure should be higher than 1.6% of GDP[3]. In the year 2001, economic growth significantly slowed down in Poland – a low level of innovation is one of the reasons for this situation. The prospects for an increase in R&D spending, especially those in business, are not good, as the majority of big firms in Poland now have foreign capital and the investors are reluctant to set up their research laboratories in Poland. It is crucial to develop small and medium sized private enterprises based on Polish capital. The SME sector in Poland is quite new as it dates from the beginning of the transformation process; it's only about 12 years old. Their way of doing business shows that they are still learning how to operate in the free market. Their innovativeness is low partly due to very weak co-operation between firms, especially a lack of horizontal links and low co-operation with such agents as public R&D institutions or knowledge intensive business services. Innovation, however, is usually a non-linear social process with an interactive nature. It almost never occurs in isolation. The weakness of the Polish innovation system in terms of the lack of linkages between agents, restricts the innovation potential of Poland and hence its competitiveness. The process of globalisation accentuates the significance of local and regional context for the effectiveness of various innovative activities. Moreover, as research done in the EC showed (Community Innovation Survey), most interactions needed for innovation are realised within the borders of a region in which a firm is located.[4] Thus Gdansk Institute for Market Economics decided to do a study of the Regional Innovation System of the Polish Pomeranian Region. As firms are the most important agents in an innovation system, we focused on investigating the linkages of firms in the system – by firm survey, while the other agents of the system were described based on an expert analysis.

1. The methodology and the definition of a Regional Innovation System (RIS)

The GIME's research was based mainly on the OECD methodology of investigating national innovation systems, as RIS can be perceived as a transposition of NIS at the regional level, referring to sub-national characteristics.[5] The survey of firms thus tried to measure the following types of linkages, which characterise

[2] Sources of data: OECD 2001; European Commission, Innovation Scoreboard 2001; GUS (Main Statistical Office of Poland) 2000 & 2001.

[3] Felbur S., Czyżewska Z. (1995), Nakłady na finansowanie nauki a wzrost gospodarczy, Ekonomista No 4.

[4] European Commission (1995) Innovative regions? A review of methods of evaluating regional potential, EIMS No 21; Surveys of Regional Innovation. A Feasibility Study for Europe, EIMS.

[5] OECD (1997) National Innovation Systems; Muller E., Zenker A. (2000) Knowledge-intensive Business Services (KIBS) and Regional Innovation Capacities, Fraunhofer Institute Systems and Innovation Research.

firms' innovation activity:

I. Interactions connected with direct R&D activity in firms:

1. **Interactions among enterprises** – joint R&D or other innovation activity of 2 or more firms, sometimes realised with the help of bridging institutions (public technology transfer institutions (TTI) or knowledge intensive business services (KIBS)),
2. **Interactions between enterprises and public R&D institutions** (universities, research institutes) – direct or indirect (via bridging institution) joint innovation activity of firms and R&D institutions.

II. Indirect R&D activity

1. Market-based technology diffusion – acquiring of codified knowledge and technology identified in machines or licences by enterprises,

2. **Transfer of knowledge via mobility of employees –** this relation comprises the primary flows of people between the educational system and enterprises as well as mobility of personnel between different enterprises and R&D institutions and enterprises. Moreover it also contains all forms of increasing the innovative potential of firms by employees' training as well as tacit knowledge exchanges during fairs, conferences and in entrepreneurs' organisations like chambers of commerce

An important feature of any innovation system including those of a national, regional or local character (innovative clusters) is that they are embedded in a specific environment and have some distinctive characteristics originating in common culture and tradition. That is the common trajectory, which allows for describing any system as a system of a specific type. It may be a common knowledge base, the same or relevant branch or the same location. National and regional innovation systems are distinguished based on administrative borders so they share common public authorities and policy. They often don't constitute natural systems, which, on the contrary, usually are clusters. The real regional innovation system occurs when the whole region constitutes a cluster of innovative agents who are linked by co-operative and competitive interactions. The internal interactions in such a system should be stronger than the external innovation interactions of the agents. Nevertheless for any innovation system it is crucial that it is open, which means it is also interacting with external agents and thus allowing for free knowledge flow from the entire world. Graph 1. presents a simplified model of a regional innovation system of the above general type.

The aim of a public innovation policy should be that an administrative region constitutes a cluster. The examples of such clusters are the most developed regions of Europe pointed out by Voyer (1998): Lombardy in Italy, Baden-Wurttemberg in Germany, Rhone-Alpes in France and Catalonia in Spain[6]. These regions and other innovative clusters like Silicon Valley, Austin (USA) or Cambridge in the UK drive the knowledge intensive development of the world. The analysis of specific characteristics of the regions-clusters shows that regional innovation system in successful regions have the following features:

1. **Economy:** higher than average GDP per capita in international/European/domestic terms; strong export orientation, high level of entrepreneurship, diversified industrial structure, significant share of high-technology industries, significant resources of well qualified human capital.
2. **R&D activity:** domination of private R&D expenditure, region is both a producer of its own technology and a user of external technology with the first role dominant.
3. **R&D infrastructure:** strong and diversified public R&D institutions and bridging institutions with a market orientation that is meeting the needs of enterprises.
4. **Policy:** clear, based on social consultation, strategy and innovation which directs the system.
5. **Social networks:** strong multi-dimensional relations and interactions between agents: linkages between industry and R&D institutions, linkages between enterprises, developed channels for tacit knowledge flows, etc.

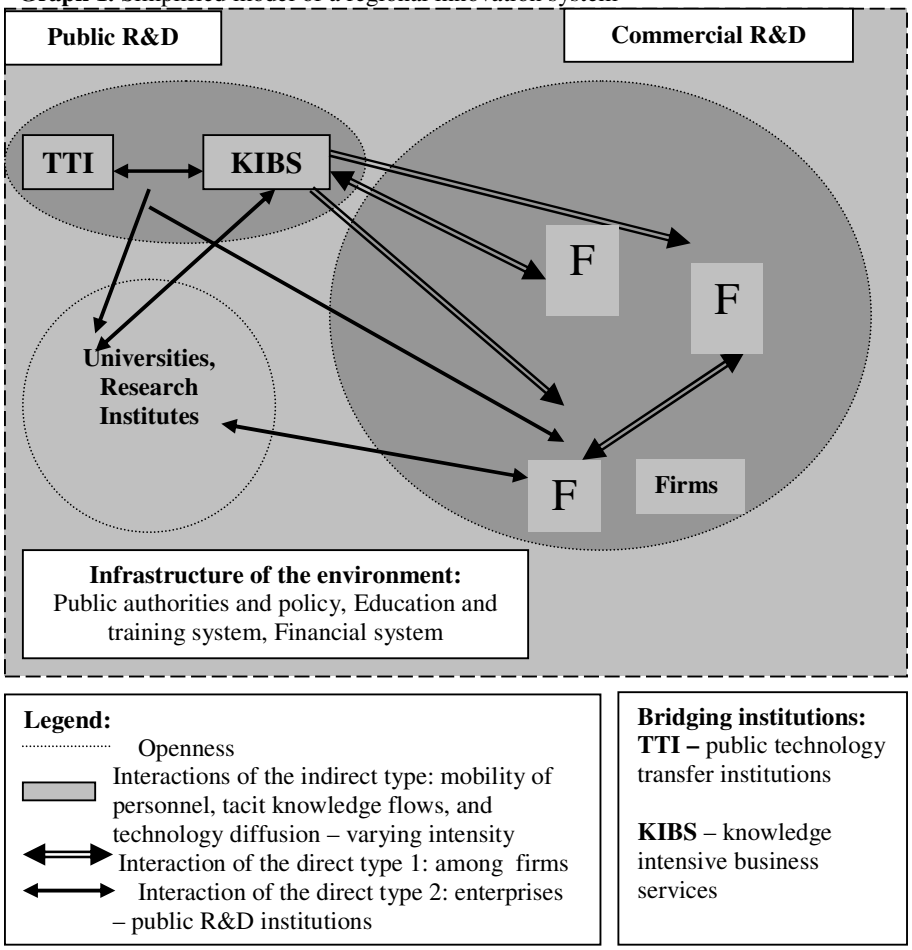
One could speak about any system of innovation where there are both static elements such as institutions and dynamic elements such as interactions. Linkages are a kind of glue that holds the elements together into a system which is a distinguishable unit having specific functions. Interactions and co-operation of the agents in a system cause quicker distribution and growth of the existing knowledge, hence innovativeness and competitiveness also increase. It is proved by the new growth theory, which says knowledge is the main factor determining productivity and economic growth. Co-operation networks have a lot of advantages: they lead to lower transaction costs and help to overcome some market failures with better information, they also cause savings by consolidating work into a single effort. Moreover, there are some specific resources like people with specific abilities and many agents would like to have access to them – co-operation in such situations is the best solution. The necessity of networks in today's economy also originates in the changing character of some sciences, which cross the borders of traditional sciences and industries like biotechnology, and co-operation is

[6] Voyer R. (1998) Knowledge-based industrial clustering: international comparisons, in de la Monthe J. & Paquet G. (1998) Local and regional systems of innovation, London.

needed for their applications. On the other hand, now it's easier to communicate and co-operate due to the development of modern means of communication like Internet and modern transportation. The interactive character of the innovation process leads to the transformation of firms – a firm of the future will have more and more functions realised by subcontracting to other entities – as it is anyway impossible to gather all the functions required for innovation in one place.[7].

Summing up, co-operation – channels of knowledge flows - are crucial for the effectiveness of any system of innovation, however it is also important – as in clusters, that the agents in general terms, remain competitors.

Graph 1. Simplified model of a regional innovation system



Source: Gdańsk Institute for Market Economy

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2.The Pomeranian Region and its innovation infrastructure

The Pomeranian Region is situated in the north of Poland on the south coast of the Baltic Sea. It is one of the 16 administrative regions of Poland, in rankings it is usually placed in the second fourth of regions. The population of the region is 2.2 mln (approx. 5.5% of the Polish population) and the majority (68%) live in cities and towns. The capital of the region is Gdansk. In the Threetown City: Gdansk, Sopot and Gdynia, which are three separate towns, geographically constituting one urban agglomeration, live about 35% of all the inhabitants. GDP per capita in the region is low in European terms as it equals about 40% of the European average but it reflects the domestic average. Average salary in the region in the year 2000 was about 456 Euro per month[8].

For the purpose of the RIS study, we divided the Pomeranian industry into two groups: non-traditional and traditional sectors. Non-traditional sectors are knowledge – based sectors (pharmaceutics, computers,

[7] Basing on: OECD, KBN (1998) Nauka, technika, przemysł – przegląd 1998; Rheines P.(2002) How to set up a local cluster, EPRC, presentation during the international conference on territorial development Paris 28-30 January 2002; Delphie'98, Introduction: How we will shape our future?, Fraunhofer Institute Systems and Innovation Research.

[8] Sources of the data: OECD, GUS.

petrochemical industry etc.), which create higher than average value-added per employee. These sectors are supposed to rely more on their own research & development activity. In contrast, traditional sectors are those of lower value-added per employee and their innovativeness is determined mainly by indirect R&D activity: acquiring technology and machines through market transactions and hiring new, better qualified employees. In terms of employment, the Pomeranian region is dominated by traditional industries (shipbuilding, food and furniture industries). Almost 69% of all workers are employed in the 12 branches of the lowest value-added per employee sector while just 7.6% are employed in the 3 branches of highest value-added per employee (petrochemical industry, publishing and printing, chemical industry). That means that the innovation policy and the R&D infrastructure should first of all consider the needs of traditional industries. In the study, we also wanted to check the hypothesis that non-traditional industries are more engaged in co-operative innovation activity than the traditional sectors.

The scientific sector is one of the positives of the region and hence the share of people with university level education is higher here than the Polish average. In 1995 it was 7.8% while the Polish average was 6.8%.[9] There are several public and private high schools of different profiles, which hire 7.6% of all those employed in high schools in Poland so it's more than the share of the region in the country's population. The number of people employed in R&D per 10,000 inhabitants in the region is a bit higher than the Polish average – 33 - but still much lower than in the EU - 52, USA - 74 or Japan - 96.

The trade fairs and exhibitions that take place in the region are mainly of middle – rank, which is partly due to weakly developed infrastructure. There is also a lack of professional conference centres, which are substituted by halls in hotels and restaurants.

In the region there are about 150 different organisations for entrepreneurs, which should be the platforms of dialog and co-operation. However, participation in them is very weak.

There are also two centres of technology and innovation transfer in the region but their impact on the innovation activity of firms is not significant, mainly due to their restricted resources. In some way the role of technology transfer among institutions is realised by the network of institutions belonging to the Domestic Service System for small and medium sized enterprises (KSU)[10]. In the region there is also a developed labour market infrastructure including centres of life-long learning and recruiting firms. However, the training courses offered in the region often don't meet market needs.

Looking at the three main blocks of the RIS infrastructure in the Pomeranian Region from the perspective of their innovative potential, the science system would have to be assessed as the best one, the bridging institutions sector as the second best and the R&D activity of firms as the weakest point.

3. Pomeranian regional innovation system from the perspective of firms – dynamic approach

In the first half of the year 2001, the Gdansk Institute for Market Economics realised a study of a group of Pomeranian firms based on a questionnaire investigating their interaction with other agents of the innovation system. The questionnaire consisted of 37 questions considering 4 types of linkages: among enterprises, firms-R&D institutions, and diffusion of technology through market transactions as well as personnel mobility. The majority of questions measured the strength of interactions on 3 levels: regional, domestic (outside the region) and linkages with foreign agents. The questionnaire was sent by post or there was a direct interview in about 400 enterprises. The rate of response was about 10% and the majority of firms that responded were of middle and large size.

47.5% of the firms that responded were firms of traditional sectors and 52.5% were of non-traditional character. 50% of the traditional firms had in the year 1999 revenues lower than 40 mln PLN and 50% of non-traditional firms lower than 27 mln PLN, while in terms of share of export sales the median was 7% in case of traditional and 5% in terms of non-traditional firms. Overall sales revenues for traditional firms fell in the year 1999 in comparison with 1998 while in non-traditional they increased. Also, the median investment expenditure for machines in 1999 was higher in the non- traditional sector: 0.99 mln PLN while in the traditional sector it was 0.225 mln PLN. Moreover, 50% of the traditional firms didn't buy any licences in the years 1998-1999 while 50% of the non-traditional spent yearly about 30,000 PLN per firm. However, while the average R&D expenditure in the non-traditional firms in this period was higher than in non-traditional firms, it was mainly due to the activity of some big firms as the median in this sector was 0 (in the traditional sector it was 15,000 PLN).

[9] However the numbers don't reveal the real situation as in the last decade there was an important increase in the number of students so the number of people with tertiary education is now estimated to equal about 13% of the population. It is still less than in neighbouring countries like Sweden – 30% and Germany – 20% (of people between 16-65 years); source: OECD, GUS.

[10] Main goal of KSU is to help SMEs and increase their competitiveness in the process of integration with the EU.

Moreover, both the average and the median expenditure for personnel training were higher in the traditional sector.

3.1.Interactions among enterprises.

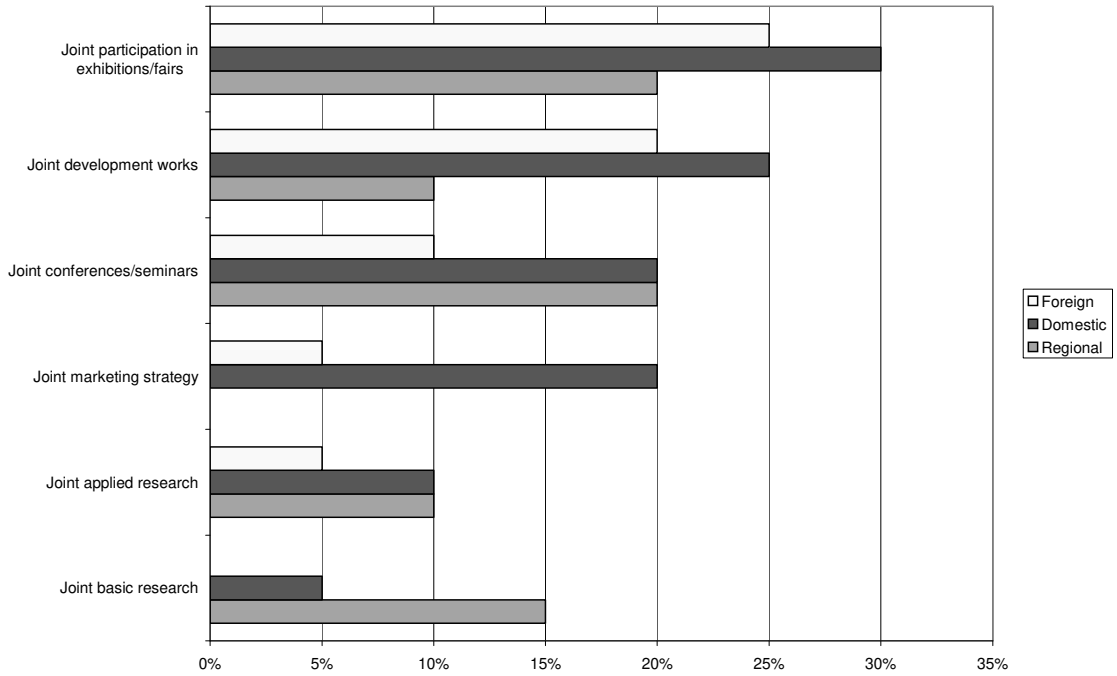
Conclusions:

1. **Firms don't see advantages in co-operation, and find it mainly a threat.**
2. **Domination of soft forms of co-operation, very weak horizontal linkages.**
3. **Lack of finance and suitable partners is not an important problem.**
4. **Co-operation with partners from outside the region is stronger than intra-regional.**

The majority of firms in both sectors don't see the need for co-operation with other firms in innovation activities. If the co-operation occurs it refers mainly to vertical linkages, that is relations with customers and suppliers. However, in non-traditional industries relations with customers were more important than with suppliers, while in the traditional it was the opposite. In the non-traditional sector, the strongest were relations with domestic agents from outside the region, although regional customers were almost equally important as domestic. In the traditional sector, the strongest were interactions with foreign and domestic suppliers, while in the case of customers, domestic were equally important as regional and foreign the least important.

Horizontal co-operation with competitors is very weak in both sectors on all three relevant levels. The barriers for co-operation reflect this situation – the most significant barrier for all firms was the prevailing opinion that other firms are competitors with which they should fight for market position (70% of firms). The firms find that co-operation in innovation could lead to stealing of their know-how and qualified employees (40% of firms). In the non-traditional sector a quite important barrier, pointed out by over 30% of firms, was the lack of suitable partners for co-operation, while for traditional firms it was the least important obstacle. One of the reasons may be that the non-traditional sector in the region and in all of Poland is much smaller than the traditional. Financial barriers like the lack of their own or public capital was a quite important obstacle (25-30% of firms) for the traditional sector while for non-traditional it was the least significant.

Graph 2. Co-operation with other enterprises in non-traditional sectors



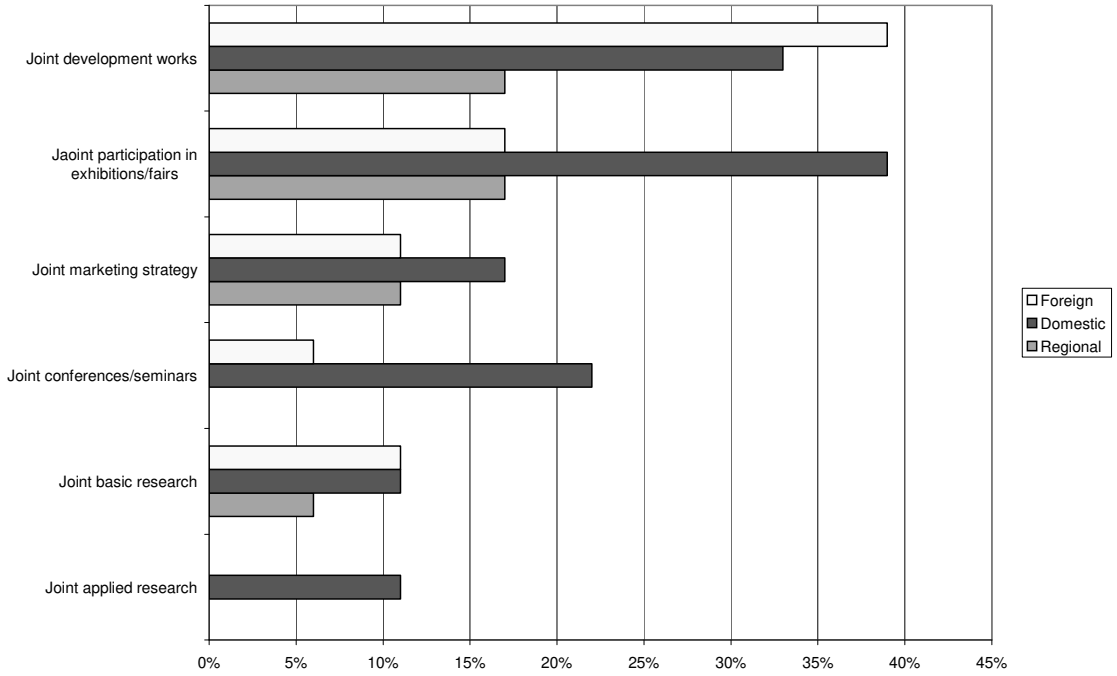
Source: Firms' questionnaire, The Gdansk Institute for Market Economy

If the co-operation among firms occurs it concerns mainly the less risky and costly phases of the innovation process like joint participation in trade fairs and exhibitions, development activity, joint organisation of trade fairs, conferences or seminars and the building of a marketing strategy. Joint basic or applied research occurred very rarely. In both sectors most important were domestic partners from outside the region. In half of

the types of linkages the intra-regional co-operation was weaker than co-operation with foreign partners. It reflects the weakness of the regional innovation system, which stems mainly from a lack of trust.

The average number of co-operative agreements in any type of innovative activity and on any geographical level was higher in the non-traditional industries: 9 while in the traditional 6. However these are the averages, which don't change the fact that about 30% of firms don't have any agreement at all (40% in non-traditional and 20% in traditional). Moreover, the share of firms having patents was higher in the non-traditional sector (31% while in the traditional 25%). However, the share of firms having joint patents with other firms was equal in both sectors – about 10%.

Graph 3. Co-operation with other enterprises in traditional sectors



Source: Firms questionnaire, The Gdansk Institute for Market Economy

The domestic innovation system is more important than regional for firms also from the perspective of participation in organisations for entrepreneurs. About 70% of traditional and 60% of non-traditional firms participate in domestic associations, while for regional ones these shares are about 35% and 45%. Participation in foreign associations is sporadic.

3.2. Interactions with public and private R&D institutions

Conclusions

1. **Very weak and sporadic co-operation with R&D institutions**
2. **Intra-regional co-operation more important than domestic especially in traditional sector, lack of overseas co-operation.**
3. **Demand for co-operation with The Gdansk University of Technology**

In both sectors dominated the response that there is no co-operation with R&D institutions. Intensive and very intensive co-operation in the non-traditional sector referred to domestic R&D units – over 20% of firms, regional and domestic technical universities – 16% and 10% of firms; and foreign R&D units and regional centres of innovation and technology transfer – 5%. In the non-traditional sector there was no intensive co-operation with private engineering or consulting firms or with universities. In the traditional sector most intensive was co-operation with regional R&D institutions: 18% of firms co-operate intensively with regional technical universities, around 12% with regional R&D units and 6% with regional universities or private engineering and consulting firms. 6% of traditional firms also declared intensive co-operation with domestic (from outside the region) technical universities and private engineering and consulting firms.

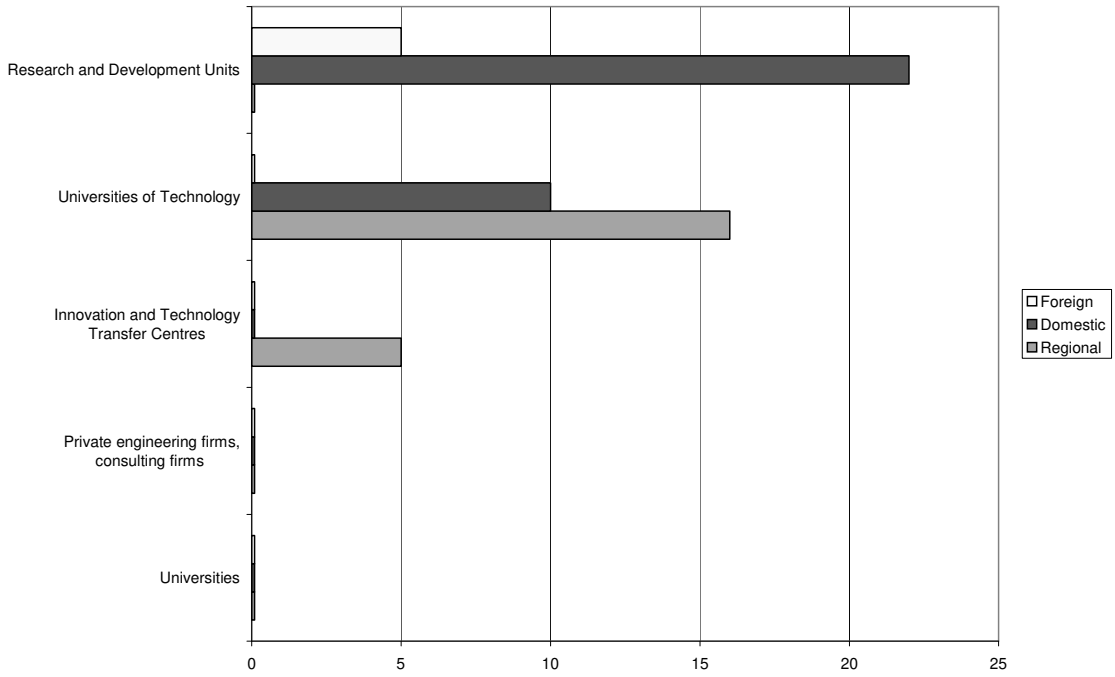
Co-operation in the R&D sphere takes mainly the form of meetings and exchange of experiences and joint development activity (respectively 40% and 30% of the co-operating firms). Joint applied or basic research with R&D institutions is carried out by about 20% of the firms that co-operate. 16% of the non-traditional and

13% of the traditional firms declared that they have joint patents with R&D institutions so these shares are higher than in the case of joint patents with other firms.

In the years 1998/1999 the enterprises commissioned studies mainly by the regional university of technology and domestic R&D units.

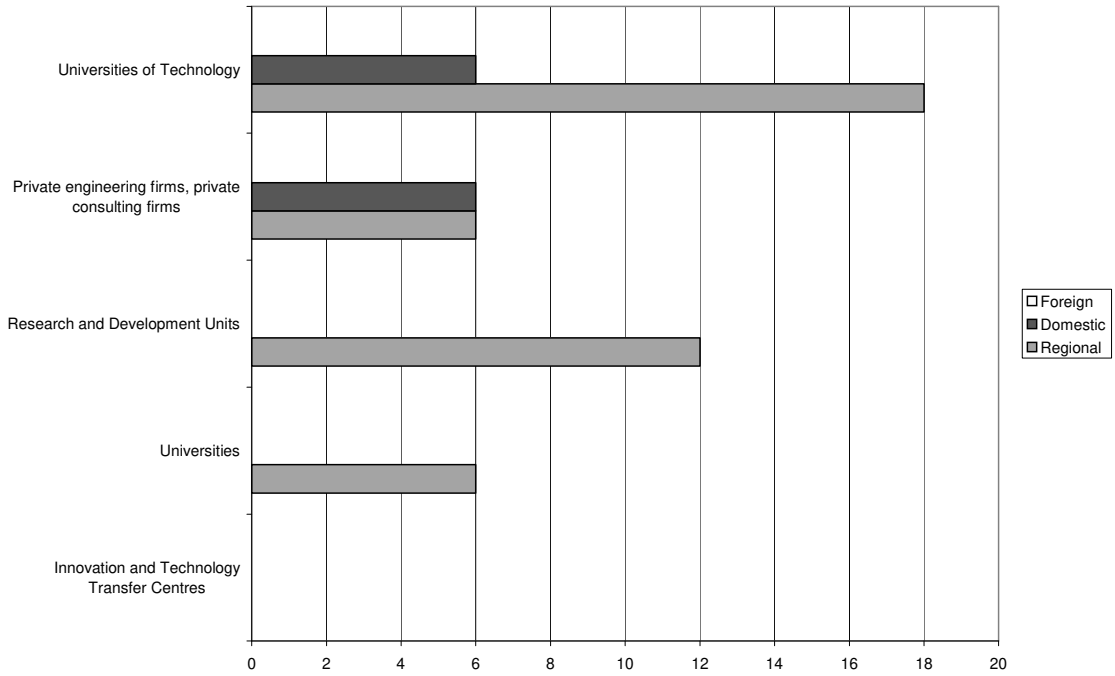
In the case of co-operation with R&D institutions, the regional innovation system is usually the most important source of partners, while co-operation with foreign partners almost doesn't exist.

Graph 4. Intensive and very intensive co-operation with R&D institutions in traditional sectors (%)



Source: Firms' questionnaire, The Gdańsk Institute for Market Economics

Graph 5. Intensive and very intensive co-operation with R&D institutions in traditional sectors (%)



Source: Firms' questionnaire, The Gdańsk Institute for Market Economics

3.3.Interactions through market transactions

Conclusions:

1. Region is a user not producer of technology
2. Most important market and private sources of information about technology

The degree of consumption of the firms' capital was significant especially in the case of machines and appliances and transport equipment – over 50%. It suggests that market transactions in the future will be crucial for these firms' competitiveness and hence the role of bridging institutions will be important in accelerating such transactions.

The Pomeranian region is mainly a user of technology – the main sources of different components of firms' capital come from foreign countries or from other regions, however foreign sources dominate as table 1 shows.

Table 1. The source of Pomeranian firms' capital

	Region		Country (outside the region)		Foreign Countries	
	NT	**T**	**NT**	**T**	**NT**	**T**
Technology for production	14%	20%	32%	25%	36%	45%
Machines and appliances	18%	15%	41%	40%	68%	85%
Specialist programs	23%	20%	36%	40%	41%	45%

Source: Firms questionnaire GIME, NT – not traditional sectors, T – traditional sectors

The main sources of information on technological news for both sectors are trade fairs, exhibitions and conferences. Important sources are also suppliers of equipment or their branches as well as specialist magazines and informal, usually private contacts in the branch. One quite important source of technology information is found by spying on competitors as well as contacts with customers and users of products. The least important sources are public R&D institutions like universities and centres for technology transfer.

3.4. Transfer of knowledge via employees

Conclusions:

1. The Region is the main source of qualified labour for firms.
2. The mobility of personnel is higher in the non-traditional sector.
3. Firms very rarely employ scientists.

All of the firms hire employees with university level education. In the non-traditional sector they represent 14.6% of the personnel while in traditional 11%. In Poland in the year 1999 this share for all those employed was 13.4%.[11] The major source of qualified employees are regional high schools – 70% of the personnel with university degrees at the surveyed firms are educated in the region, while only 30% in other regions of Poland.

Mobility of employees between firms and firms and R&D institutions may be measured by the rate of employment of new people. New employees usually bring new knowledge and ideas. In the non-traditional sector, new employees represented in the period January 1999-June 2000 16% of the workforce, while in the traditional 7.5%. This share was lower than the share of new employees throughout Poland in the year 1998 – 20%.

In both sectors, 70-80% of the new employees came from other enterprises. None of the firms employed people from R&D institutions. At the end of the year 2000, only about 16% of the traditional and 20% of the non-traditional firms employed people with PhDs or professors.

Conclusions

The Pomeranian innovation system has a quite well-developed infrastructure when considering the static elements, although there are some shortcomings like a lack of platform institutions for dialog between firms or the lack of conference centres. However, the dynamic elements – channels for the flow of knowledge through co-operation - are very weak. The majority of firms are reluctant and afraid of co-operation with other firms and the co-operation with R&D institutions is sporadic. Moreover, if interactions occur they refer mainly to partners from outside the region. Intra-regional co-operation is important only in terms of contacts with R&D institutions. The weakness of this regional innovation system is partly due to the weakness of regional firms' association. The majority of firms in the region belong to various national business associations. However, co-operation on the regional level might be more effective. Regional authorities should induce such dialog between firms and other regional agents.

The Pomeranian region, and the entire country, is mainly a user and not a producer of technology. To sustain the long-run competitiveness of industry it is crucial to enhance the R&D activity of Polish firms, preferably based on co-operation with other agents of the innovation system.

The region's economy is based on traditional industries and their needs should be of primary importance. However, there is also potential, especially human and scientific, for development of knowledge intensive sectors, which create higher value-added. The regional innovation policy should include incentives for development of high technology industries.

In the Pomeranian Region, public authorities are willing to support the regional innovation system (RIS). In the Regional Strategy for Development written in 2000, one of the main priorities is building an effective regional innovation system. As this study has shown, it should encompass specifically instruments stimulating interaction and co-operation among the various agents of the system.

[11] However, in high technology firms in the Gdansk region people with university education represent 60-70% of the personnel ; source "High-technology clusters in the Gdansk region" GIME 2001

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