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Knowledge Environment in Clusters – Warsaw Agglomeration And Norcom

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Abstract

This paper touches upon the knowledge environment (KE) as a factor attracting foreign direct investments (FDI) to clusters. Clusters - geographic concentrations of interconnected companies and associated institutions - can enhance the regions' attractiveness and stimulate inflow of FDI mainly thanks to the features such as closer cooperation, tacit knowledge, low communication costs, and other advantages stemming from proximity.

KE has been conceived as one of the sources of clusters' attractiveness and is defined as an ecosystem conducive for broadly defined knowledge processes. This concept has two dimensions - knowledge base and knowledge mechanisms - assuming that cluster does not only posses certain knowledge attributes such as scientific institutes or pool of highly qualified labor force but it also provides for necessary elements facilitating the dissemination and accumulation of knowledge, such as social networks, spillovers, etc.

Besides literature review, field study qualitative research has been conducted. It encompasses in-depth interviews with the representatives of NorCOM – North Jutland Wireless Communications and Maritime Communications and Navigation Cluster in Denmark and a quasi cluster (cluster in statu nascendi) around Warsaw. The results obtained indisputably indicate clusters offer an environment favorable for foreign investors conducting research and development activities (R&D). However, confronting the Polish and Danish cases revealed the perception of knowledge environment differs between these two cohorts.

Keywords

innovation, cluster, foreign direct investments (FDI), knowledge, research and development (R&D)

1. Setting The Stage – Clusters' Attractiveness

Clusters are defined as geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or region [1]. M. Porter assumes that firms in a cluster both cooperate and compete. As he argues, competition and cooperation can coexist because they are on different dimensions or because cooperation at some levels is part of winning the competition at other levels. Maskell and Lorenzen see clusters as hybrid forms of long-term contracting, reciprocal trading, residing somewhere between hierarchies and markets [2]. However, cluster concept seems to be very elastic and imprecise in academic as well as policy circles [3].

Despite these shortcomings, clusters are believed to posses the discreet charm of obscure objects of desire [4]. The charm rests on the assumption that regional specialization on interlinked activities of complementary firms and their cooperation with public and private research institutions creates synergies, increases productivity and leads to economic advantages (however defined).

In order to address these imprecise pulling forces of clusters three possible sources of clusters' attractiveness have been distinguished. The Authors own research concentrated specifically on: pecuniary agglomeration economies, knowledge-conducive environment and favourable business conditions enabling lower transaction costs.

Discussion, whether clusters might be attractive place for FDIs, draws on confronting multinational enterprises (MNEs) expectations and motives while going abroad with clusters' features and mechanisms. It had been assumed that clusters' attractiveness for

FDIs means that simultaneously: clusters provide agglomeration economies, knowledge spillovers, and reduced uncertainty level, and MNEs pursuing FDIs are explicitly searching for these phenomena or at least regard them as important determinants while choosing location. For the research purposes agglomeration economies refer to two sources of Marshall's externalities – namely labor pool and input-output linkages [5]. These agglomeration economies can be understood as positive external effects deriving from the spatial concentration of companies leading to cost reduction and revenue rise [6,7].

Uncertainty has been distinguished as the second source of potential clusters' attractiveness, as the analysis concerns the clusters' role for foreign investors and those are especially affected by information asymmetry and other problems stemming form non-locality. Moreover, it gives account to the duality of clusters' existence. It may be namely regarded as "bottom-up" or "top-down" phenomenon, i.e. natural, spontaneous one or political, designed one. It must be noted that classifying cluster strictly to such dimension is almost impossible, as all clusters seem to reveal features of both extreme situations. Uncertainty is considered in terms of information asymmetry, where the information (data) itself is a notion smaller than knowledge. Uncertainty concept may be as well regarded in terms of transaction costs and "organizing capacity" (which clusters are supposed to provide). It is reasonable to assume, that this capacity, including social support, public-private partnerships, views, strategies, and leaderships as intangible assets, contribute to the atmosphere of trust [8].

Broadly understood knowledge as a source of clusters' attractiveness for FDIs has been distinguished due to the intangible character of this production input, mainly so called "tacit knowledge" [9,10,11]. Special attention devoted to clusters stems from growing role of knowledge-seeking FDIs, and the phenomenon of KBE – knowledge based economy [12,9,10].

Knowledge environment (KE) is understood as an ecosystem conducive for knowledge production, dissemination, development and accumulation. KE is perceived as a two-dimensional notion, i.e. as including both knowledge base and knowledge mechanisms. This term is connected with competencies defined as existing knowledge and capability of its application. It assumes that cluster does not only posses certain knowledge attributes such as university, scientific and research institutes or pool of highly qualified labor force but it also provides for necessary elements facilitating knowledge dissemination, accumulation development such as various cooperation platforms, business-education forums, social networks, spillovers, etc.

Review of theories and empirical studies points to the importance of KE for foreign investors. Theories such as asset-augmenting (exploiting) or knowledge-seeking FDI stipulate the MNEs' interests in gaining access to foreign knowledge sources [9, 13]. Simultaneously, Marshall's approach or "regional learning" and "learning region" concepts suggest, that cluster may be an environment conducive for various research and development activities (R&D) entailing knowledge creation, diffusion and spillovers [5, 14].

As far as empirical studies are regarded, it must be noted that in most statistical analyses knowledge enters the models as R&D expenditures, R&D personnel, patent count, etc, thus accounting for the stock of knowledge in the region, its endowment in knowledge rather than knowledge spillovers [15]. Moreover, as some studies have shown, FDI should come form technologically "laggard" countries and be interested in gaining access to knowledge rather than coming form "leading" countries and thus being afraid of loosing home-base knowledge to competitors [16]. Although, not unambiguous, the results of empirical analyses point to the importance of localized knowledge for foreign investors' decisions.

Field studies consisting of in-depth interviews in high-tech cluster in Denmark and in quasi cluster in Poland enabled a more closer look at knowledge environment as a source of clusters' attractiveness and are discussed in next chapters.

2. Norcom – Making The Most of Knowledge Environment

2.1. Norcom – Background and Institutions

NorCOM, being a high-tech cluster, is defined as "joint knowledge base which includes electronic signals transmitted in the air by radio waves" [17]. It dates back to the year 1948, when Simon Petersen set up a company S.P. Radio. In the 60s his company stopped producing consumer electronics and diversified into developing and producing maritime communication equipments. Over the next nearly 50 years until today NorCOM has been undergoing the turbulent history. Many firms have been closed down, some have been overtaken, but simultaneously many new have been either set up from scratch or attracted to the cluster from outside. The life cycle of NorCOM seems to be closely linked to the technological life cycle in wireless and mobile communication science. The first phase marked as "cluster emergence and early formation" refers to Nordic Mobile Technology. NMT is regarded as the 1st generation of mobile telecommunication. The second phase distinguished in the 80s and 90s brought about "NorCOM consolidation" and is linked to the 2nd generation of mobile technologies, namely GSM (Groupe Speciale Mobile -2G). Year 2000 and the "dot.com crises" shook the foundations of NorCOM, however, cluster seemed to have overcome the contemporary "problems connected to UMTS" (Universal Mobile Telecommunication System – 3rd generation) and is now facing another challenge – 4G.

NorCOM consists of two parts representing two interconnected areas of activity: wireless and mobile communication and maritime navigation and communication. NorCOM as a club of firms within telecommunication sector was set up in 1997. In year 2000 it obtained a more formal character when it became an association of enterprises having its own board of directors. NorCOM is frequently depicted in the form of complex genealogy tree showing the history of cluster since its early beginnings.

Aalborg University (AAU), Centre for Teleinfrastructure (CTIF) and Science Park NOVI belong to "science environment" of NorCOM [18]. Besides, many small and medium enterprises and R&D units of Danish as well as foreign companies operate in NorCom.
Aalborg University was established in 1974 with the aim of activating regional development. It consists of three departments Humanities, Social Science, Engineering and Natural Science. Aalborg University is renowned for its teaching methods "student-centered, problem-oriented, project-group work". According to many researchers, Aalborg University seems to play an important role in regional development comparable to that played by Cambridge University around Cambridge. Hence, the idea of so-called "Aalborg Phenomenon" [19]. Moreover AAU aims at fulfilling, with equal commitment and engagement, tasks within all three pillars of modern universities. This means that besides traditional roles – providing education and conducting researches - it is also involved in multifaceted cooperation with outside actors; Danish as well as foreign, private as well as public. Moreover, the object of the University is to safeguard the highest possible level of its graduates' education level and thus the qualifications of a future labor force. It is expected to react swiftly to ongoing changes; modifying old curricula and faculties and introducing new ones. Since - as revealed by many empirical studies – labor force is geographically very immobile the responsibility for providing well educated employees rests almost solely with local universities.

Another institution constituting the research landscape is Centre for TeleInfrastructure (CTIF). Established in 2004 it is the leading center in research and education in wireless technologies. It has more than 130 employees organized in 10 research groups, which conduct research aiming at enhancing the technological development within modern wireless communication technologies and teleinfrastructures. The main idea behind CTIF is disseminating latest research results into industry environment. CTIF coordinates or/and participate in several projects, among which: MAGNET (6th Framework UE, My Personal Adaptive Globar Network), JADE (Joint Advanced Development Enabling 4G), 3C (Communication, Connectivity, Convergence), DRUID (Danish Research Unit of Industrial Dynamics), DIME (Dynamics of Institutions and Markets in Europe).

As far as organizational structure of CTIF is regarded it consists of: Industrial Advisory Committee made up of top managers from the industry; Research Council meeting according to the needs, mainly to give advice in strategic research matters and Management Team responsible for the daily technical and administrative management as well as Steering Committee responsible for updating the overall research visions seen from both industrial and academic perspectives.

Finally Science Park NOVI (*Nordjyllands Videnspark*) created in 1989, is a unique combination of Science Park, innovative milieu, as well as venture capital provider. The main task of NOVI is to support the creation and development of knowledge-based companies and set up of R&D units. NOVI provides funds for NorCOM activities and serves as a location for emerging small and medium enterprises (SME) and university spin-offs. Its unique role consists in attracting world renowned experts, scientists and researchers. They ensure that researches are conducted on the highest intellectual level. This shall attract new investors – mainly R&D units of foreign companies, which in turn may contribute to further development in the region.

2.2. Foreign Direct Ivestors (FDI) and the University – existing patterns of cooperation

Many international corporations such as Nokia, Siemens-BenQ, Analog Devices, Texas Instruments have taken advantage of the cluster competencies and established development centers around Aalborg. The cooperation between academia and private sectors in NorCOM seems to be well developed. Interviews with foreign investors operating in NorCOM conducted within the SPIRIT Scholarship over the period of September 2005 - January 2006 pointed out not only to the importance of such cooperation but also revealed the multiple forms of “business – science relations”.

The managers of following foreign companies have been approached: Texas Instruments (TI), Radio Frequency Micro Devices (RFMD), Analog Devices (AD), End2End and Siemens-BenQ. All these companies have been engaging in different forms of cooperation with the University. They frequently hire graduates, grant scholarships for students, and sponsor PhD students. Moreover some of them tend to take advantage after the students as a test group for new technological solutions. Private firms order at the University expertise and occasionally consult researchers. They also assist University in the daily operation and provide equipment for University classrooms – PC rooms. Companies organize and participate in seminars, scientific conferences and workshops. The special requirement concerning private companies’ involvement in projects sponsored by the EU is additional reason for active participation in many undertakings. Moreover, it is widely recognized and accepted that scientific staff - professors as well as other lecturers and teaching assistants - work on a part-time basis in R&D units of private companies. Simultaneously employees with private companies are often a part-time censors and supervisors at the University. Interviewed managers from international companies underline how important it is to make company visible at the University among students.

This shall ensure that future graduates are aware of the company's (as a possible employer) presence in the region.

The results of the field studies carried out in NorCOM underline unambiguously the role played by the University. All interviewed foreign investors highlighted the importance of University's researchers as well as scientific groups for companies' activities. The very close and very vivid cooperation between private sector and academia contributes much to the local development and thus it improves the attractiveness of this place for next foreign companies.

3. Warsaw – Shying The Full Potential of Knowledge Economies

3.1. Science and R&D Activities in Mazowsze Against the Background of Poland

As far as science, education and R&D activities are concerned, Mazowsze (voiewodshiphs with the capital city Warsaw) stands out clearly. Regardless of the indicators applied it tops all rankings and scoreboards. There are 90 universities in Mazowieckie voivodship, followed by 37 in Śląskie, 31 in Małopolskie and Wielkopolskie and 29 in Dolnośląskie [20]. The number of academic teachers employed in capital region supports clearly the statement above. As far as the number of students is regarded, Mazowsze tops the ranking with the result of 350 thousand, followed by Śląsk – 200 thousand, and Małopolska - 177 thousand. 275 units conducting broadly understood research and development activities are located in Mazowsze. In the second best region – Śląsk – there are only 112, in Małopolska – 86 and in Wielkopolska – 74. Obviously, the large number of R&D units correspond with the scientific staff employed. Mazowsze also possesses the advantage over other regions as far as R&D expenditures are considered. In 2005 with more than two billion PLN spent on R&D Mazowieckie voivodship is far ahead in the ranking. In the second best region – Małopolski Money envisaged for R&D amounted to 520 million PLN, whereas in Śląskie it totaled 374.9 and in Wielkopolskie 358.2 million PLN.

According to the Institute of Market Research (IBnGR), peculiar quantitative concentration of R&D activities can be observed in Mazowsze, particularly around Warsaw [21]. However, quantitative analysis cannot be regarded as a proper and sufficient cluster identification. Since these measures do not allow to state as to the character and strengths of linkages and interactions among cluster's members, further qualitative studies are required. To this end interviews, surveys and all form of observation can be applied. As some experts underline, since it is impossible to get feedback from all cluster actors, the chosen representative group shall be selected and approached. Due to the character of the field-study conducted in NorCOM, this carried out in Warsaw dealt as well with foreign investors. It particularly focused on investors' perception of clusters attractiveness and the role played by localised knowledge.

3.2. Warsaw quasi-cluster

Referring to the cluster development evolutionary model put forth by Stoerring and Dahl, it can be stated that there is indeed regional agglomeration of competences in Mazowsze, particularly around Warsaw, nevertheless the mature cluster has not emerged yet [19]. So called triggering effect hasn't occurred yet. As mentioned before, in order to keep the Warsaw field-studies in line with those from Denmark, interviews have been conducted with foreign investors. However, bearing in mind the relative small size of R&D activities in Poland and the fact, that no cluster as such exists so far, interviewed were foreign investors operating not only in Warsaw. Motorola case (Motorola has in Poland its R&D unit in Krakow, whereas the marketing and other sale related activities are under the

responsibility of Warsaw centre) can be regarded as an enrichment of the analysis, suggesting general interest a cluster might evoke among foreign investors in Poland, regardless of the location of potential cluster. Questions asked in Poland was modeled on those raised in NorCOM in order to allow further comparative analysis.

According to Polish Information and Foreign Investors Agency (PAIiIZ) in 2005 there were 11 R&D units belonging to foreign investors and operating around Warsaw [22]. Following investors have been approached: SAS Institute, Samsung Electronics Software R&D Centre, Motorola Warsaw and Software R&D Centre Krakow, TPSA/France Telecom, Material Engineering R&D Centre of Pratt&Whitney at Aviation Institute and General Electric Engineering Design Center (GE EDC). Answers obtained from the Polish case study can be interpreted both in terms of current situation (i.e. the existing threats and/or benefits of operating in particular area and thus this place's attractiveness) as well as in terms of future, potential cluster's attractiveness (i.e. which factors and characteristics might contribute mainly to cluster's attractiveness).

Concerning knowledge environment in the area answers obtained point to various arts of possible co-operation. Investors quite often participate in workshops, trainings and seminars at universities. They frequently hire graduates and offer traineeships for students. Ordering expertise at universities is much less widespread. Likewise, students are seldom employed as a test group for new devices, application, etc – an activity often practiced in Aalborg.

Moreover, as compared to Norcom, a company's employees simultaneously active in academia are rare. As academic teachers employed in private firms are. Joint i.e. including more than two parties projects, or programmes can be actually regarded as non existent. There are same cases of sponsorships usually applied within the framework of Corporate Social Responsibility with the aim to improve company's image and reputation.

Due to very limited financial resources available at higher education institutes foreign investors do preferentially sell own products and services – such as computer software. Talented students can expect scholarships though no programmes of industrial PhD or classified PhD have been implemented so far.

Results obtained indicate science – business cooperation is assessed as symmetrical and mutually beneficial. Though it is limited to "two partners" cooperation.

Investors express worries and concerns as to the academic offer. They argue universities' output does not much their expectations. It either falls short of business needs or is almost completely unsuitable. The scientific results are not adapted to entrepreneurs demands and often useless. Lack of willingness to cooperate might be addressed by initiatives such as the one launched in 2006 by the Ministry of Higher Education and Science – establishing Warsaw Scientific Consortium. It aimed at starting with a new platform for cooperation. However, investors didn't welcome this initiative warmly. Apparently, companies don't see visible and tangible benefits of such collaboration. They are reluctant and shy away from sharing valuable knowledge with others even if they may benefit themselves from such engagement. For the moment investors seem to doubt whether being involved can bring some profits to the company. What is more they fear losing some competitive edge to rivals (they explicitly mentioned risk of knowledge stealing). They are even reluctant to share their problems aware it may help solving some issues. Risks seem outweigh possible benefits. Though seemingly sceptical towards ministry initiative, investors admit such steps are precondition and prerequisite for their involvement. Local administration shall thus act as broker and animator providing for certain rules and

safeguarding fair play among commercial entities. It will be perceived as monitoring body coordinating activity and guarantying equal treatment.

On the positive side one has to note the existing (though very limited) possibility to influence and shape tutorial programmes. Particularly professors employed simultaneously in private companies shall act as liaisons enabling exchange of information between "two worlds" academia and business. They are up to date with university as well as companies needs and thus can bring these two closer together for instance by influencing research curricula Other studies on science - business cooperation in Poland confirm the existing gap between these "two worlds". Academia still has a specific sense of mission skewing more market oriented approach whereas in other western European countries scientists and researchers seem to be used to be rewarded for success in business.

4. Conclusions – Knowledge Environment – Important Though Differently Perceived

Clusters seem to be attractive for knowledge-driven FDIs, since the geographical proximity and frequent contacts among actors it offers, facilitate knowledge flows – essential for these FDIs. Cases labeled spin-offs, when new firms enter the same industry in which their founders were previously employed are regarded as the vehicle of knowledge transfer [23]. Other channels of knowledge diffusion include workers' inter-firm mobility with the emphasis put on issues like loyalty towards company, managers attitude towards mobility, coercive methods like non-competitive clause which aim at limiting employees' mobility. While facilitating knowledge processes within clusters one has to be aware of the role played by informal contacts. Besides official projects, programs and other initiatives of high importance are social informal contacts, social events, even rumors, and gossips. Interviewed in Norcom managers emphasized social aspects of knowledge sharing and existence of so-called "cafeteria effects". Empirical studies as well as NorCOM case indicate that knowledge may be beyond the reach of FDI, if appropriate mechanisms are not in place. Investors may benefit only on the account that knowledge generated and existing in local environment may flow freely. This implies different forms of cooperation and exchanges, both formal and informal one; i.e. projects, programs, as well as social meetings. Moreover, it requires that there are no (or low) social barriers, which may prevent local entities from sharing knowledge [24].

Referring to the two dimensions of knowledge environment (base and mechanisms) it seems, as the Warsaw case indicates, that Polish cities and regions possess knowledge potential; i.e. they are equipped with knowledgebase (universities, scientific institutes, high schools, pools of a well educated workforce). Nevertheless, they often lack knowledge mechanism (all framework and processes, which facilitate knowledge circulation). These cannot be underestimated since they are a prerequisite for knowledge accessibility for foreign investors. Providing for knowledge mechanism not only make existing knowledge-base accessible for FDIs and thus make a given place attractive for FDIs. It also enables commercialization of B&R results. As argued by Lezard (2005), the University may attract foreign investors and provides them with a flow of new ideas and knowledge. However it provides usually only intellectual capital without business skills to develop it [25]. Therefore what is important is the peer pressure in the cluster which encourage people to develop commercial ventures rather than stopping at R&D stage.

Results of research conducted in Poland and Denmark clearly state FDI running R&D centres valued (or would value in a would-be cluster) most the knowledge environment and rank it as the most important source of cluster attractiveness. Though, the perception

of KE among foreign investors residing in Aalborg and those from Warsaw differ considerably. In both cases interviewed groups are relatively small though they account for approximately half of the respective cluster size (as far as foreign investors' population is concerned) thus can give insight into examined problem.

Companies operating in NorCOM are fully aware that innovativeness being prerequisite for competitiveness require interactive learning. In Poland, however, many firms seem to regard knowledge sharing as detrimental to their innovativeness (at least as judged by their behavior). In this respect, the latest initiatives like the one establishing Warsaw Scientific Consortium might be breakthrough development. It may namely encourage cooperation between different entities and thus create a "culture of knowledge sharing".

Referring to two dimensions of KE one can easily state that Warsaw investors certainly put more emphasis on knowledge basis than on mechanisms. Cooperation is perceived as a risky activity possibly leading to leakages of some valuable know-how or information to a competitor. Wheras NorCom entities seem to see the brighter side of such collaboration, rather as a source of useful cross-fertilization. Moreover cooperation in Warsaw has a limited scope and in most cases happens between two sides – thus has a bilateral character. Platform of cooperation including multiple actors do exist in Norcom. Business in Norcom seem to have a proactive attitude towards knowledge environment. Actions such as shaping curricula or initiating workshops are in Warsaw rather in a very nascent phase. Investors have barely started harnessing existing potential. Whereas well established and popular is schema of summer traineeships, absent or rare are cases of classified dissertations.

Summing up, it seems that investors operating in Warsaw benefit mainly from knowledge base – abundance of and easy access to qualified workforce. They value the variety of choice facilitated by proximity. Foreign companies in Norcom aim at getting more involved in local knowledge environment, achieving certain interlocking or embededness, all facilitated not only by proximity but first of all - by trust.

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