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Industrial Clusters: Concepts and Empirical Evidence from East-Central Europe

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Summary: Industry clusters (ICs) have attracted much attention in the recent past. Besides the ever-growing academic interest, ICs have become primary targets of development policy, similarly to foreign direct investment (FDI) attraction and the development of local linkages (for example, supplier networks) of foreign investment enterprises (FIEs). Both structures, ICs and widespread supplier networks, have common features. Most importantly, both need a sufficient number of potential collaborators. Both can be developed most successfully in regions where economic activity is vivid and enterprising and cooperation has traditions. It is therefore of special interest to learn what should and could be the relationship between the two cooperation systems, what are their common features, and what are the differences. These are the issues examined in this paper, both from theoretical and empirical points of view, this latter based on the example of the Hungarian and other CEE economies' experience.

Zusammenfassung: Industriecluster haben in der jüngeren Vergangenheit viel Aufmerksamkeit auf sich gezogen. Neben dem immer wachsenden akademischen Interesse wurden Industriecluster primäre Ziele von Entwicklungspolitik, gleichermaßen attraktiv für ausländische Direktinvestitionen und die Entwicklung von lokalen Verflechtungen (z. B. Lieferantennetzwerke) ausländischer Investmentunternehmen. Beide Strukturen, Industriecluster und verbreitete Lieferantennetzwerke, haben gemeinsame Eigenschaften. Am wichtigsten ist, dass beide eine ausreichende Anzahl an potenziellen Kollaborateuren brauchen. Beide können sich am erfolgreichsten in Regionen entwickeln, in denen ökonomische Aktivitäten lebhaft sind und in denen Unternehmertum und Kooperation Traditionen haben. Es ist deshalb von speziellem Interesse, zu lernen wie eine Beziehung der beiden kooperierenden Systeme sein sollte und was sie tun könnte, was ihre gemeinsamen Eigenschaften und ihre Unterschiede sind. Dies sind die Themen, welche in dieser Abhandlung untersucht werden, sowohl vom theoretischem als auch vom empirischen Blickwinkel, wobei Letzteres auf dem Beispiel der Erfahrung ungarischer und Mittel- und Osteuropäischer Ökonomien basiert.

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1. Introduction

Clusters have attracted much attention in the recent past. Other than ever growing academic interest, clusters have also become primary targets of development policy. Various documents of the EC[1] expressed strong confidence in clusters being exceptionally suitable drivers of economic growth, innovation and competitiveness. National governments in addition to the EC supported policies designed to promote the process of clustering and the establishment of cluster organizations. Another important string of literature and policy practice is foreign direct investment (FDI) attraction and the development of local linkages (most importantly supplier networks) of foreign investment enterprises (FIEs). Both structures clusters as well as widespread supplier networks have common features. Most importantly, both need sufficient numbers of potential collaborators. Both can be developed most successfully in regions where economic activity is vivid, and within which enterprising and cooperation have traditions. Clustering processes seem to be especially strong in businesses producing complex products. Labor division has large potential also internationally in the most globalized industries, like electronics-ICT technologies or the automotive industry. Hot spots of these industries may effectively attract firms and investments from a fairly wide geographic area.

Agglomeration of economic activity is a phenomenon which has occurred as long as human history. Centers of active and vibrant economic development and welfare have attracted various businesses for centuries. As early as the work of MARSHALL (1890), there has been an awareness of the importance of geographical proximity in determining the location of industrial activity. MARSHALL argued that clusters develop as a consequence of three factors: (a) the presence of a skilled local labor market, (b) key inputs from suppliers and (c) rapid know-how transfer between firms leading to technological spillover. Hence, regional concentration is not a new phenomenon. What is then new to the discussion of clusters?

The industrial clustering work of PORTER (1990, 1998 and 2003) is regarded as seminal. PORTER emphasized that firms' competitiveness was determined by multiple factors only partly endogenous to them. In his "diamond model", four sets of interrelated forces were brought forward to explain industrial dynamics and competitiveness. These were associated with factor input conditions, sophisticated local demand conditions, related and supported industries, and firm structure, strategy and rivalry. A core notion arose around his model, stressing that collaborative, mutually supportive groups of actors could enhance regional competitiveness in global markets and thus create growth and other benefits. Also, the significance of face-to-face contacts and personal demonstration, exchange of experience, the role of geographical proximity for knowledge transfers and innovation has been explored and emphasized. Another string of related economic thought elaborated on knowledge creation and innovation as a social process engaging individuals that exchange tacit and explicit knowledge. Trust-based relationships and social capital may thus be important for enabling horizontal cooperation between individuals within and across firms and institutions (POUDER and ST. JOHN, 1996; SAXENIAN, 1994). Clusters are spatial

1 EC (2003); EC (2007); EC (2008a); EC (2008b)

concentrations of business and related institutions with activity specialization and active cooperation linkages among cluster members[2]. Clusters' activity may be facilitated by cluster organizations (cluster initiatives), yet the later are institutions rather than economic phenomenon and we must therefore make a clear distinction between these. The essence of clusters is the cooperation of members, with the main benefits they realize stemming from joint actions; this goes beyond the mere co-location of firms.

One important feature of globalization is the grooving importance of large transnational companies (TNCs) in organizing international cooperation networks in global industries. Foreign investment enterprises (FIEs) may also benefit from cooperation with clusters related to their core activity. Nevertheless, the linkage is more often the opposite. Local companies and more importantly governments promote joint actions sometimes organized as clusters in order to facilitate cooperation with FIEs. One of the main FDI-related policy aims is to promote a greater embeddedness of these within the local economic environment and a loosening of their island-like appearance in the host economy. Developing local linkages, however, requires actions from both sides, FIEs as well as local firms. Governments usually have greater influence on local small and medium-sized firms and can better facilitate their efforts to become suppliers of FIEs. An interesting new tool in this effort is cluster promotion, and their potential role in facilitating FIE local supplier networks[3].

We can approach clusters on different levels. Since co-location of business in close geographical proximity is an organic development, we can focus on the real economic clustering process, that is, how spatial concentrations of certain activities evolve or show up in a given time of observation. This is an important aspect since benefits of close cooperation among firms are expected to arise when cooperating agents exceed a certain number, the so-called "critical mass"[4]. We can make observations using statistical analysis of activities at the local level. First such an extensive "cluster mapping" exercise was carried out in the US by MICHAEL PORTER'S team at Harvard Business School. Since then, several similar calculations were made using Porter's original method. In this paper, we review previous mapping exercises and introduce our own results for Hungary. Other studies approach existing cluster organizations and try to draw conclusions using survey data. One of the first larger scale empirical surveys of cluster initiatives was carried out at the Stockholm School of Economics by SÖLVELL et al. (2003). The research work that has been carried out in Stockholm ever since has strongly determined the European view of

2 MICHAEL PORTER'S original definition for clusters is as follows: „Clusters are geographic concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (PORTER, 1998, 199). The main aim of this cooperation is enhancing competitiveness of regions and actors in the region.

3 For more details on supplier network promotion programs in Hungary see: SASS and SZANYI (2004), ICEG, (2006); SASS et.al. (2009)

4 One main precondition of successful cluster operation is the presence of a fairly large and diverse pool of economic agents specializing on similar or supportive activities. The sufficiently large specialized local economic activity is crucial for knowledge generation and transfer, for the internal stability of cluster organizations, for the „visibility" of clusters and for the self-sustaining development of cluster activities. For more general descriptions and about various interpretations of the cluster concept see: PORTER, (1998); SÖLVELL et.al. (2003); ICEG, (2007); SÖLVELL, (2008); EC, (2008b); SZANYI, (2008b).

clusters. This influence has been expressed in European papers' strong emphasis on clusters' role in curbing the innovation process. This idea has become part of the re-emerging industrial policy concept of the EUROPEAN COMMISSION as well.

2. Clusters´ role in the organization of supplier networks of multinational companies

Clusters are flexible production platforms with some kind of activity specialization. Cluster operation can be targeted directly to consumer markets but also to supplies of specific intermediate products. In some cases clusters are organized as an alliance of equal parties (i.e., firms with similar size and importance), in other cases organization is more satellite-like and there is one or a few large companies which determine cluster activities according to their input demands. In this later case, cluster participants and activities are organized in order to enhance the competitiveness of the whole value chain on top of which usually there are multinational companies. It is important to emphasize that FIE-centered clusters may work properly only on the basis of mutual benefits. Cluster cooperation, which is largely sponsored by the FIE, must bring benefits for suppliers in terms of technological upgrading, market access, and sometimes even financial support. Benefits of FIEs may range from access to less expensive and flexible local supplies to better labor force pool and technology assistance.

Clusters' essence is mutually beneficial co-operation of various economic actors. Hence, true clusters expand beyond the mere FIE supplier networks. They include non-business participants and their activity goes beyond technical organization of supplies. Most common is technology and knowledge transfer to facilitate small suppliers' technical and managerial capabilities. There is also financial support to undertake necessary investments. However, in this type of cooperation there is relatively little emphasis on innovation and technological cooperation, at least for the time being.

Potentially, FIEs may be also important players in the innovation process of clusters. They were always regarded as primary sources of technology to the host transition economy. Whenever their local involvement increases interfaces of technological spillovers also widen. Hence, clusters, may serve as good platforms of knowledge transfer between FIEs and local actors. The concept of dynamic clusters[5] emphasizes innovative cooperation among partners rather than one-way transfers of knowledge. It is not self evident that FIEs'

5 SÖLVELL et al (2003) run the first major questionnaire-based empirical survey on clusters worldwide. Using the survey results they described a typical or best practice cluster type: the most common appearance of clusters. Because of overrepresentation of clusters from developed market economies, this model, which they called „dynamic cluster" reflected basically those characteristics, cooperation forms, structures that were found typical in more developed economies. Later research (e.g. KETELS and SÖLVELL, 2005; KETELS et.al., 2006) revealed the fact that in emering market economies or developing countries clusters may substantially differ concerning their focus of activity and working models.

strategies exceed the technical minimum of knowledge transfer towards suppliers. Their links to local universities or research laboratories also depend on many factors that are independent from cluster policies (SASS and SZANYI, 2004).

TNCs are desired participants of clusters (SÖLVELL et al. 2003). They may support cluster development in several ways. They are in direct contact with world markets and can potentially bring breaking news to the cluster first hand. Through their widespread international linkages these companies may support international activities of the cluster and smaller cluster members. They may even lobby for their partners' interests. Another potential support area is technology. Transnational companies have usually cutting edge technology, and are able to provide technology and knowledge transfer to strategic partners. In case of stable supplier contacts, technology transfer and enabling policies provided for suppliers are rather usual. The intensity of such linkages very much depend on their level of inclination for supplier network development with nationality, global strategy as perhaps the strongest determinants. Another technology-related area is R&D. One of the essential cluster functions, especially in the case of dynamic clusters is knowledge generation and distribution within the clusters. Should there be intensive R&D linkages within the cluster members, including research institutions and universities, it is likely that also transnational companies participate in this collaboration. Related to knowledge generation is training and education. This is also based on cooperation of heterogeneous partners as well as including transnational companies.

We think that at least for the time being emerging market economies do not offer strong conditions for knowledge based dynamic clusters or innovation systems that could provide strategic innovation inputs for transnational corporations, though many of them possess strong innovation communities that could potentially serve as knowledge generating network with international importance. Thus, TNCs' interest in developing deep cooperation networks including cluster participation is weaker in emerging market economies than in developed countries. Nevertheless, similarly to conditions for developing supplier networks, also cluster participation is plausible and desirable, albeit the likelihood and modes of participation may vary greatly. In the next section we compare conditions of supplier network development with those of cluster establishment from the angle of TNCs using the Hungarian experience. This comparison will also highlight possible ways of organizing clusters based on existing supplier networks of TNCs.

In general we can expect that factors increasing the likelihood of supplier network development also increase propensity of cluster involvement. However, the two phenomena are not identical, and in some cases interests may substantially differ. It is therefore necessary to consider these determinants also from the cluster viewpoint. These are the following: spatial concentration, specialization, heterogeneity of actors, simultaneous competition and cooperation, critical mass and typical cluster activities.

As far as geographic concentration is concerned, we can immediately realize that in Hungary the main areas for FDI are identical with those of intensive cluster development. It is mainly the capital city, and the Northern and Western Transdanubia region where both clusters and FDIs accumulate. In fact, investments started to settle in important agglomerations already in the 1990s, meanwhile cluster development (meaning formal cluster initiatives) started only after 2000. Causal relations are rather unclear, hence these

regions used to be rather developed industrial centers already prior to the transition period, and their production potentials very much contributed to FDI attraction. Later this attraction potential was further strengthened by the TNCs themselves. Leading original equipment manufacturers (OEMs) attracted their traditional suppliers to invest in the same region in order to ensure easy and smooth cooperation. This FDI pattern itself contributed to large extent to the creation of sufficient pools of specialized firms within close vicinity. OEMs also exercised strong pulling effect on local suppliers. While many of them had their premises in these historic industrial districts, new firms also settled into them. This process was strengthened by some policy measures as well. For over a decade or so special industrial zones enjoyed special privileges in form of tax and customs relief, provided they exported their output entirely. Tax free zones became hubs for greenfield investments, that also incorporated many Hungarian suppliers (ANTALÓCZY and SASS, 2001; SASS, 2003).

Much of the export-oriented greenfield investment was carried out in the tax free zones, however, we also have to note that some 100 such zones were created in Hungary, since regulations for the establishment were rather easy to meet. Therefore, the likely pattern of spatial concentration was one OEM and its traditional first tire suppliers, furthermore local second and third tire supplier companies. Only in rare occasions settled OEMs with similar final product into the same hub. They separated themselves from their competitors, and seemed to prefer separation of their supplier network as well (SZALAVETZ, 2001).

Consequently, significant concentrations of specialized firms were created in Hungary's more developed areas. These networks consisted of technologically dependent suppliers of the value chain of single OEMs. The types of cooperation also served the smooth functioning of the chain. Technology and knowledge transfer was provided by the OEMs and other major firms to Hungarian smaller suppliers in the areas and to the extent it was necessary to improve their supply capabilities. The knowledge transfer, but generally speaking, all cooperation links were vertical: the OEM being in the centre, and other firms depending on them as satellites. Not only OEMs avoided contacting other OEMs of their branch, but horizontal linkages of suppliers were also curtailed (at least not promoted). This means contacts to other TNCs, but also linkages among suppliers (for example in the case of Electrolux[6]). There is some evidence that TNCs liked sporadic suppliers also because they could bargain lower prices when handling with separated, individual companies (SZANYI, 2008a). Summing up, FDI created hot spots for potential cluster development, but TNCs were not really interested in creating cooperation and communication platforms among supplier firms, which would be an essential cluster function.

We must emphasize the role of the tax free zones in spatial development of industrial districts in the first phase of the transition period. The advantageous regulation was however, lifted while joining the European Union, since it was not regarded as compatible with competition rules. Also in this period there was another pattern of FDI in Hungary which was more connected with the privatization process, and was regarded as more likely

6 See for details: ICEG, 2006

leading to the development of supplier networks. From the point of view of the development of horizontal linkages, or the possibility of becoming suppliers of several firms, various OEMs there is anecdotal evidence proving that the linkages were more frequent in these cases. However, TNCs were in many of the privatization cases not more interested in the further development of suppliers' horizontal linkages. Nevertheless, "inherited from the past" cooperation among some of the local based suppliers might remain intact. Hence, propensity around these OEMs can be more likely than in the case of greenfield investments.

Another aspect of cluster development is the heterogeneity of members. It is rather clear that supplier networks around TNCs serve primarily the business interests of the integrating company. Anything which is beyond this interest must be initiated by other parties. The day-to-day interest of TNCs is simple: they must run their production facilities smooth efficiently (many of them are efficiency seeking). They need reliable business partners in the value chain. But basically, and especially in the early years of their investments they do not care much about the broader background. Many TNCs regard investment projects as one off deals that lasts until favorable conditions prevail, but do not intend to get involved in supporting the longer term provision of the conditions. Therefore institutions of the broader production background (education, infrastructure development, etc.) remain outside of their attention. Therefore, the usual early phase local production networks usually lack diversity, which would be an important feature of clusters.

This situation is changing with the age and development of investment projects. There is much empirical evidence that show how even greenfield investments changed their nature and behavior (SZALAVETZ, 2005; SZANYI, 2003, HUNYA, 2001). For it is in their own efficiency seeking interest to tap cheap opportunities in (almost) the whole value chain. Therefore, FIEs expand activity from final assembly of imported parts to increasing local component supply, to increasing local participation in corporate functions (from accounting through logistics even to R&D). This expansion of affiliates' activity in the global corporate networks is in line with the current wave of concentrating on core competences and outsourcing/offshoring much of the activities (SASS, 2008). The more activities are carried out locally the more likely business and cooperation links are developed in various directions exceeding the simple technological cooperation of suppliers. Whenever there is more room for contacts among heterogeneous market actors, potentials also increase for organizing these contacts and actors in some formal ways. Clustering process may get started from the bottom too.

Recent experiences with labor shortage in some industrial bases in Hungary opened up new frontiers of cooperation with TNCs. National Instruments in Debrecen, Siemens in Budapest, Nokia in Szeged, Audi in Győr are just a few examples when TNCs participated in shaping and also financing education programs of universities. Of course, they do this because they need further high quality labor supply. Another welcomed development pattern is the increasing participation of TNCs in financing and partly also carrying out R&D projects in Hungary. Some of the leading investors in Hungary established R&D laboratories in the country. This also substantially increased clustering potentials of some cities where sufficient educational and innovation background was present. We do not think that dynamic clusters will soon play important role in Hungary's economic

development. It is good if TNCs at least realize that they may also benefit from cluster cooperation in Hungary, and become active members of clusters. Nevertheless, the mere fact that universities, R&D facilities, maybe also other actors raised their interest also support the cluster idea and increases chances for proper cluster actions.

Concerning the coexistence of cooperation and competition Hungarian clusters may play positive role. TNC supplier networks always supported intensive competition among local firms. Cooperation was rather lacking, though it was very much in the interest of local firms to improve their abilities in joint actions rather, than individually. Clusters may play important role in organizing various programs for the development of participating SMEs. This is also in the interest of the TNCs heading the value chain. Other forms of cooperation, most importantly technology and knowledge transfer maybe even generation is also plausible in supplier-based clusters, especially if cluster members can change their way of thinking of vertical flows, but recognize that there is also room for joint horizontal actions. The empirical evidence indicates that this is most difficult task of cluster managers, since many of the potential cluster members are competitors and compete for contracts of the top OEMs or first tire foreign suppliers. Finding ways of making TNCs interested in cluster cooperation is sometimes not more difficult then trust building among competing local suppliers.

As far as the critical mass of clusters is concerned there is very little information on this issue in Hungary. Empirical surveys indicated that formal cluster organizations do not set such targets (SZANYI, 2008a). Many are in their early stage of development, thus the question is not yet relevant for them. Nevertheless, we can draw some general conclusions using guidelines of the literature (SÖLVELL, 2003, ECOTEC, 2003; CLOE, 2006). Achieving of a critical mass is important for three reasons. One is stability (against potential dropouts of large, dominating firms), the second is self-sustaining cluster (financially and also in terms of new entry attraction), the third is achieving also a critical mass of information flow and activity (a kind of density of cluster actions that provides the desired synergies). TNC supplier networks alone have little chance to achieve these goals. Membership of competing OEMs is not likely. However, there may be clusters that are not initiated and dominated by OEMs, but are established by other parties, building on suppliers to TNCs. In this case the initial favorable condition of the supplier network is utilized, namely that there is a pool of potential cluster members. Using this pool a cluster can be organized with or without the participation of the TNC itself. The case of the oldest and largest Hungarian cluster the Pannon Automotive Cluster (PANAC) is a good example for this. However, even this cluster could not develop activities away from simple supplier network support for many years. It took time and some setback in the cluster's activity until cluster management realized that proper cluster functioning cannot be based solely on supplier network development programs (GROSZ, 2006). Representing the cluster's own interests as separate organization is crucial, and cannot be subordinated to one company's business interests. Also, professional cluster management is necessary to be employed, so that regular cluster functions are developed.

3. Cluster mapping

While the origins of clustering included mostly bottom-up organizations, increased interest in cluster development as policy tool resulted in large numbers of clusters that did not have traditional or organic spatial development roots. Many times it was governments that boosted the organization of cluster initiatives. If countries wish to launch a thoroughly designed program, information has to be gathered and evaluated first. For the purpose of promotion of clustering process, or the foundation of cluster organizations, it is necessary to check if conditions for clustering are given or not. Two characteristics are crucial. First is spatial concentration, the second is specialization on some core competence. It is rather obvious that in the case of a top-down initiative these characteristics can be controlled in advance. It is quite surprising, that cluster mapping has not yet become a general practice by governments. It is only the USA, where nationwide effort was made in the late 1990's. Some countries also calculated spatial concentration measures, but even these efforts were not always given the right attention by policy makers. For example, in Hungary, there was such an effort in 2003, but it was conducted when the cluster promotion program has already been opened for applications (RAVN and PETERSEN, 2005). An *ex-post* survey compared the identified clusters with the list of existing cluster initiatives. Only 10 of the then 22 Hungarian cluster initiatives matched the hot spot map which identified 24 examples of above average spatial concentration of industries (GECSE, 2004).

The above mentioned weak result of match by actual cluster initiatives and statistically registered spatial concentrations raises the question of how to explain this failure? Was it the inappropriate analytical framework that created distortions in the mapping procedure? Or rather, it was due to a high number of "virtual cluster initiatives"? Or maybe, and most likely, do both explanations contribute to an overall explanation?

Without going into detail, a brief overview of methodological problems is due here. The cluster mapping procedure tries to identify spatial locations where the representation of certain industries or economic activities is higher than average, i.e. where they seem to concentrate. The logic is simple, in these places there must be some kind of a competitive advantage that is perceived by economic actors, and they tend to co-locate. There are three types of industries that have different reasons to co-locate. A large number of manufacturing branches and even more service providers (typically personal services) are located right at their markets. The dispersion of such industries is roughly even in all regions. Per capita measures for example are very close to each other in the various geographic regions of a country. Natural resource based industries on the other hand tend to concentrate mainly at the location of the valuable asset. These industries may serve the global market, but they do not have much locational choice. The third group of activities is most important for us, these are industries that concentrate at locations, hence, they choose among many potential sites. These industries are regarded as cluster-industries. In the case of the US economy their proportional share in employment was close to one third, but they recorded higher than average wages, productivity and innovation (KETELS and SÖLVELL, 2005).

KETELS and SÖLVELL (2005) run a comprehensive statistical survey of cluster mapping in the 10 new member states of the EU. Their methodology was based on the methods of a

survey that was conducted at the Institute for Strategy and Competitiveness at Harvard Business School led by MICHAEL PORTER[7]. The European survey used the amended American industrial classification method when identifying those business activities which belonged to cluster-industries. Spatial concentration was calculated for the European NUTS-2 level regions. Only employment data was readily available at this level of both sectoral and geographic dis-aggregation (38 businesses), and for two more recent comparative years (2000 and 2004). Thus, concentration was measured with this single data set. However, the authors calculated three different measures, in order to limit some of the distortions stemming from the special features of employment data. They wished to obtain a balanced picture of regions reaching sufficient specialized critical mass to develop the type of spillovers and linkages that create positive economic effects and can serve as a base for cluster initiatives.

The first measure expressed the size, if employment reached a sufficient absolute level that may trigger strong economic effects of clusters. This level was set for each NUTS-2 region and every of the 38 branch at 15000 employees at a location. The second measure expressed specialization, if a region was more specialized in a specific cluster category than the overall economy across all the regions, this was thought to provide enough strength for the regional cluster to attract related economic activity from other regions. This notion was operationalized by regarding fit those concentrations that reached a specialization quotient of more than 1,75, i.e. which had at least 75 % more employment within the given cluster, than the average of all regions would suggest given their size. The third measure expressed dominance, if branches employ a high share of the given region's overall employment. The measure was set at the level of 7 % of overall regional employment. The level of all three measures were set to separate the highest 10 percentile of all regional clusters.

As expressed also by the authors, the measurement method had several shortcomings. First being the usage of solely employment figures, this created bias towards labour-intensive sectors. Another problem is the level of dis-aggregation in both dimensions. The 38 activity groups or businesses contain many that are rather heterogeneous. A deeper level of disaggregation was not possible, since the original grouping pattern (which was based on more detailed surveys of the US economy) could be transformed from the American SIC classification structure to European NACE only at this level.

As concerns NUTS-2 regions, they are also too big in at least some countries and for some activities. In Hungary, for example, NUTS-2 regions were artificially created as requested by the EU, but they consist of usually 3 former *comitats* which used to be the integrating geographic and administrative unit historically. The new NUTS-2 regions are so young that their economies could hardly amalgamate. On the other hand, there is no convincing evidence on clusters spreading according to administrative borders either. Thus, maybe some clusters escaped mapping because they spread over two or even more NUTS-2 regions.

7 See: http://data.isc.hbs.edu/isc/index.jsp

A further problem comes from the inheritance previous industrial structures. In most socialist countries, production was heavily concentrated in large state-owned companies. In some cases these huge *combinates* were located in places of arbitrary choice, in other cases firms were created in the strive of these countries for self-supply in practically all commodities in the middle of nowhere. In many cases these giants or the remnants of them survived the turmoil of the transition process. In other cases the least mobile production factor labour stayed at places where they were settled during the years of socialist industrialization. All this experience seriously distorted spatial concentration patterns from the hypothetical optimum, and the old patterns still exercise influence on spatial differences in the supply of production factors. Thus, we may have strong reservations as far as the applicability of the results of current cluster mappings are concerned.

KETELS and SÖLVELL's survey found nevertheless interesting results. We summarize them in the following. 367 regional clusters met at least one of the three hurdle rates for absolute size, specialization and dominance. They represented 5,86 mn employees, about 58 % of total employment in the cluster sector of the 10 new member states. The capital regions of the largest countries lead the ranking of regions by cluster portfolio strength: Budapest first, Warsaw second, Prague fourth place. The largest seven cluster categories were food processing, heavy construction services, transportation and logistics, financial services, hospitality and tourism, metal forming, and building fixtures, equipment and services, and accounted for 50 % of all cluster sector employment across the EU 10. As is seen, it is mainly labour intensive branches with relatively lower level of productivity: a clear indication for sample bias (automotive or ICT employed much less people, albeit they used to be considered as leading sectors for many clusters).

The research confirmed existing hypotheses concerning the development gap between developed country and transition member states in the EU. The EU 10 economies had a specialization profile distinct from more advanced economies. Specialization was found to have far stronger natural resource driven sector (20 % share in employment) than developed countries. Within the cluster sector (32 % share in employment) there was a stronger bias towards labour intensive and manufacturing driven cluster categories, while these countries were relatively weak in advanced services and knowledge intensive cluster categories. Exceptions were the strongest clustering centres around capital cities. Also, in case of the Hungarian clusters, the above mentioned bias was less pronounced and specialization towards high value added services and industries was stronger (see the attached list below).

Table 1: Strong regional clusters and their specialization 2004, (Clusters qualifying for the top 10 % in all three measures)

Regions	Field of specialization
Czech Republic	
Liberec	Automotive
Liberec	Textiles
Ostrava	Metal manufacturing
Praha city	Education and knowledge generation
Praha city	Entertainment
Praha city	Financial services
Praha region	Automotive
Hungary	
Győr	Automotive
Szeged	Food processing
Székesfehérvár	Information technology
Lithuania	Apparel
Latvia	Entertainment
Poland	
Gdansk	Transportation and logistics
Katowice	Automotive
Lodz	Apparel
Warszawa	Financial services
Wroclaw	Automotive
Slovakia	
Bratislava	Financial services
Kosice	Apparel
Kosice	Metal manufacturing

Source: KETELS and SÖLVELL, 2005 pp. 62-65.

There may be several factors affecting the results of the above table, which seems to be rather rigorous. For example no Slovenian cluster qualified itself in all three dimensions. KETELS and SÖLVELL (2005) found convincing evidence on the correlation of spatial concentration and economic performance using the data of developed countries. However, spatial concentration had different historic reasons in practically all the EU 10 countries, and these traditions seem to have much weaker causal link to economic growth and performance today. For example, in the case of the strong position of the Kosice region in the Slovak Republic we must not forget, that this is one of the poorest regions of the EU 25. The Kosice steel mill and very few other industrial facilities are the single most important employer of the region where unemployment rates are extraordinarily high. Thus, we may observe cases for which spatial concentration of business is the result of an overall meltdown of business activity in some regions, and not the beneficial outcome of deliberate co-location decision of independent cluster actors.

It is perhaps more useful to look at regional centres' overall clustering performance. The next table contains the list of regional centres that attracted the largest cluster portfolio, i.e. businesses that qualified in one or more aspects of cluster measures.

Table 2: Regional clusters with strongest portfolio in EU-10, 2004

Region	Total number of qualifications	Average qualification per regional cluster	Share of qualified clusters in total regional cluster employment (%)
Budapest	23	1,53	77
Warsawa	22	1,38	77
Katowice	21	1,4	81
Praha city	19	1,9	78
Lithuania	19	1,58	70
Krakow	18	1,29	68
Liberec	17	1,55	62
Lodz	16	1,6	71
Wroclaw	16	1,45	60
Poznan	15	1,15	72
Nitra	14	1,4	60
Bydgoszcz	14	1,27	58
Slovenia	14	1,27	56
Olomouc	14	1,4	45
Latvia	13	1,44	62
Gdansk	13	1,44	59
Praha region	13	1,63	43
Bratislava	12	1,5	65
Brno	12	1,2	56
Miskolc	12	1,09	51
Kosice	12	1,71	45

Source: KETELS and SÖLVELL, 2005 p. 26.

There are large differences within the EU-10 across regions and cluster categories regarding their level of specialization and spatial concentration. These countries show much lower specialization on specific regional clusters within regions and much lower spatial concentration on specific regions within cluster categories than the original benchmark US economy. If as is suggested by the authors, higher levels of specialization and concentration enable higher productivity and innovation, this is a serious concern. The same concern arises with regard the EU-15 countries in comparison with the US, which is fully consistent with the performance gap relative to the United States.

The European Union picked up PORTER's idea and its extension by SÖLVELL and addressed dynamic clusters (in EC terms "innovative clusters") one cornerstone of the more concrete and operative implementation plan of the Lisbon targets by the mid 2000's. The emphasis on cluster development via European means gave new impetus for cluster research as well. Based on previous works at the Stockholm School of Economics new research institutions were created. The European CLUSTER OBSERVATORY started to work in 2005. One main research output of this institution is its cluster mapping database[8]. The database contains employment data broken down according to PORTER's original categorization of "traded clusters" for the European NUTS 2 level regions. The same types

8 See: http://www.clusterobservatory.eu

of measures are calculated than what was used in KETELS and SÖLVELL (2005). Thus, the problem of using only one indicator (employment), as well as the too broad and rather rigid separation of regions still remained in this database. Nevertheless, the availability of methodologically comparable data for the whole territory of the EU is an important new feature in cluster research. Also, the database contains some basic evaluation of the registered clusters' exports and innovative activities that helps readers identifying the "true innovative clusters".

As far as the actual results are concerned, data of the observed Hungarian clusters are summarized in the next table. As is seen, none of the spatial concentrations in Hungary qualified in all three measurement aspects in 2007 (in 2004 there were three). The number of two-stars clusters also declined. Some of the 2004 two stars clusters lost one star, but in two cases (building fixtures and business services in Central Hungary) the 2004 clusters were not mentioned in the 2007 table. On the other hand, 6 "new" two star clusters appear in 2007 table. They are certainly not new in the sense that these spatial concentrations have been rather known, since they used to have rather solid and traditional background, and qualified from one to two stars level.

Table 3: Evaluation of Hungarian clusters (2007)*

All regional clusters in Hungary (1,2 and 3 star regional clusters)								
Region	Cluster category	Employees	Size	Spec.	Focus	Stars	Innovation	Exports
Kozep-Magyarorszag	**Transportation**	50163	0,81%	1,23	4,00%	**	High	Weak
Kozep-Magyarorszag	Education	44476	1,00%	1,89	3,00%	**	High	N/A
Del-Alfold	**Food**	34101	0,68%	2,89	7,00%	**	Low	Weak
Kozep-Magyarorszag	**IT**	30735	1,00%	2,26	2,00%	**	High	Strong
Kozep-Dunantul	Automotive	17091	0,66%	2,85	4,00%	**	Low	Strong
Nyugat-Dunantul	**Automotive**	16741	0,64%	2,98	4,00%	**	Low	Strong
Kozep-Magyarorszag	Biopharma	14197	1,00%	2,61	1,00%	**	High	Weak
Kozep-Dunantul	**IT**	12535	0,61%	2,64	2,00%	**	Low	Strong
Kozep-Dunantul	**Building Fixtures**	11702	0,50%	2,17	2,00%	**	Low	Strong
Nyugat-Dunantul	**IT**	10995	0,54%	2,47	2,00%	**	Low	Strong
Nyugat-Dunantul	Lighting	6888	1,00%	6,17	1,00%	**	Low	Very strong
Kozep-Magyarorszag	Lighting	6832	1,00%	2	0,56%	**	High	Very strong
Del-Dunantul	Leather	3086	1,00%	10,32	0,95%	**	Low	Weak
Kozep-Magyarorszag	**Finance**	43439	0,61%	0,92	3,00%	*	High	Weak
Kozep-Magyarorszag	**Entertainment**	28559	1,00%	1,96	2,00%	*	High	Very strong
Eszak-Alfold	**Food**	22460	0,45%	1,73	4,00%	*	Low	Weak
Eszak-Alfold	**Construction**	18230	0,28%	1,07	3,00%	*	Low	N/A
Kozep-Dunantul	**Metal**	17403	0,44%	1,92	4,00%	*	Low	Weak
Kozep-Magyarorszag	**Publishing**	16886	1,00%	1,55	1,00%	*	High	Weak
Eszak-Magyarorszag	Food	16116	0,32%	1,51	4,00%	*	Low	Weak
Kozep-Dunantul	Construction	16020	0,24%	1,06	3,00%	*	Low	N/A
Eszak-Magyarorszag	Construction	15650	0,24%	1,11	3,00%	*	Low	N/A
Kozep-Dunantul	**Food**	15246	0,31%	1,32	3,00%	*	Low	Weak
Nyugat-Dunantul	Food	14718	0,29%	1,36	3,00%	*	Low	Weak
Del-Dunantul	Food	14374	0,29%	1,63	4,00%	*	Low	Weak
Del-Alfold	Construction	13783	0,21%	0,89	3,00%	*	Low	N/A
Eszak-Magyarorszag	**Metal**	13190	0,34%	1,57	3,00%	*	Low	Weak
Nyugat-Dunantul	Construction	12918	0,20%	0,91	3,00%	*	Low	N/A
Kozep-Dunantul	Transportation	12078	0,20%	0,85	2,00%	*	Low	Weak
Nyugat-Dunantul	Hospitality	11702	0,32%	1,47	2,00%	*	Low	Strong
Del-Dunantul	Construction	11151	0,17%	0,96	3,00%	*	Low	N/A
Del-Dunantul	Finance	9012	0,13%	0,72	2,00%	*	Low	Weak
Eszak-Magyarorszag	Chemical	6130	0,64%	2,97	1,00%	*	Low	Weak
Eszak-Magyarorszag	Communications	5910	0,74%	3,47	1,00%	*	Low	Very strong
Kozep-Dunantul	Communications	5890	0,74%	3,21	1,00%	*	Low	Very strong
Nyugat-Dunantul	Heavy Machinery	5341	0,64%	2,97	1,00%	*	Low	Weak
Eszak-Alfold	Heavy Machinery	4362	0,52%	2,02	0,92%	*	Low	Weak
Del-Dunantul	Communications	4333	0,54%	3,09	1,00%	*	Low	Very strong
Del-Alfold	Constr, Materials	3863	0,64%	2,72	0,89%	*	Low	Weak
Nyugat-Dunantul	Communications	3475	0,44%	2,01	0,87%	*	Low	Very strong
Kozep-Magyarorszag	Jewelry	3445	1,00%	1,75	0,28%	*	High	Weak
Eszak-Magyarorszag	Lighting	3357	0,65%	3,04	0,85%	*	Low	Very strong
Eszak-Alfold	Lighting	3084	0,60%	2,3	0,65%	*	Low	Very strong
Eszak-Alfold	Footwear	3066	0,70%	2,71	0,64%	*	Low	Weak
Del-Alfold	Oil and Gas	2372	0,67%	2,84	0,55%	*	Low	Weak
Del-Dunantul	Fishing	1369	0,38%	2,16	0,42%	*	Low	Weak
Eszak-Alfold	Leather	1167	0,69%	2,65	0,24%	*	Low	Weak
Nyugat-Dunantul	Leather	1041	0,61%	2,83	0,26%	*	Low	Weak

*: A brief description of the calculation method is provided in the text. In case of the size one star was given to clusters that belonged in this regard to the top 10 % of all clusters in the EU concerning this feature. The % figure in this table shows the actual share of the given Hungarian cluster in Europe's total (total employment in the given sector in all European clusters). In the case of specialization values over 2 earned one star. For the notion of focus those clusters got one star, which belonged to those 10 % of clusters that contributed the most to total local cluster employment. The % figure in the table shows the actual share of the cluster in employment of the region.

Those clusters that also appeared in KETELS and SÖLVELL's 2004 table are bold.

Source: http://www.clusterobservatory.eu

Looking at the 2007 list of Hungarian clusters, we can observe the still strong positions of traditional sectors. This is despite of the less favorable development tendencies during the 1990's and 2000's. Strong path dependency is observed here. Despite of massive foreign investments in some global industries, like automotive, electronics and communication technology, important features of the Hungarian economy prevailed: food industry, construction, light industry still retained important positions despite of heavy contractions during the past 15 years.

Another important message of the table is that innovation was found strongest mainly in sectors that did not export much and did not belong to traditional high technology activities. The loose relationship of high-technology, innovation and exports calls for caution when designing cluster promotion tools aiming at "export-oriented innovative clusters", which is at the heart of the current Hungarian but to some extent, also the European innovation policy (see for example EC 2008a, 2008b, EUROPEAN CLUSTER OBSERVATORY, 2007). PORTER stressed the importance of innovation in cluster activity, but never mentioned that clusters were "reserved" for high-technology activities, or for export-oriented industries. Heart of his concept is joint action for increasing regional competitiveness in general. One tool of this strive is supporting innovative cooperation in a wide range of industries and activities. Equally important in the cluster concept is its basing on traditional regional sources and areas of competitiveness. These should be promoted by cluster cooperation. Clusters should not be regarded as means of "capitalist industrialization".

The results of the KETELS and SÖLVELL (2005) study suggest further research in mapping spatial concentrations of business activity in the "traded cluster" sectors. It seems to be necessary to use alternative indicators like sales turnover, investments or paid salaries (instead of the number of employees). Also, strict administrative boundaries of NUTS 2 regions should be treated more flexibly to allow the observation of "cross-border" clusters, or less spread spatial concentrations that "disappear" from calculations when comparing them with aggregated figures of larger areas. Such refinements in methodology will enhance a more reliable comparison of functioning cluster organizations and their background. Which in turn would also contribute to a better formulation of cluster policies.

4. ICT- and automotive industry clusters in Central Europe

As it has already been argued, ICT and automotive industries have strong potentials for cluster building. The main reason of this is that both industries' production structure is rather complex, can easily be sequenced, thus allowing the participation of many specialized suppliers. PAVLINEK and JANAK (2007) described the process of vertical disintegration during the 1990s in the car industry, with special regard to the Czech case as well. He stressed that Czech car production was traditionally strongly integrated vertically, with over 50 % added value share of the final assembler. This situation changed already prior to the privatization of Skoda Auto in the early 1990s. Outsourcing to local and foreign suppliers gained momentum after VW's purchase of the firm. Similar processes took place in many other globalized industries and firms also in Central Europe. Local suppliers, but to even a greater degree, traditional foreign suppliers settled near to the main assemblers. PAVLINEK and JANAK (2007) found evidence that first tire component suppliers (usually other large TNCs) settled close to the Mlada Boleslav center of Skoda Auto, meanwhile second and third tire suppliers (most of the local firms in the supplier chain) tended to remain in their spatially more distant locations. Thus, a special kind of clustering process was detected in the Czech car industry. Thus, PAVLINEK and JANAK (2007) described 4 clustering centres in the Czech Republic's automotive industry. However, the authors did not define precisely what they understood under clusters.

The paper itself called simple co-location (industrial districts) clusters, and concentrated on the elaboration of supplier chain development. As we argued previously, the existence of co-located supplier chains may form the potential base of porterian clusters. PAVLINEK and JANAK did not check whether true cluster functions, especially horizontal cooperation linkages developed among the over 200 supplier companies. The paper does not mention the existence of a formal cluster organization (cluster initiative) either. Hence, we assume that the VW-based Czech automotive cluster exists mainly in the sense of a large potential pool for the essential horizontal cooperation, and is in reality rather a huge, well organized production platform. Nevertheless, new booklets of CzechInvest (the Czech FDI-promotion agency) also include potential R&D facilities and universities that are readily available for innovative cooperation in the automotive sector. This information also substantially improves chances of the establishment of a porterian cluster hence it provides options for the necessary heterogeneity of the participants.

SOVIAR (2009) briefly summarizes the results of an international research project on clusters in the Zilina region. Cluster mapping calculations showed strong specialization on traditional industries like timber and wood and textiles. However, given the small scale of the Slovak ICT industry, high LQ value was obtained for this branch as well (albeit at a fairly low size level: only 3000 employees). Heavy industry, especially military production (trucks and heavy guns) also had traditions in this region, and based on these Slovak researchers also found likely that an automotive cluster can be developed. Two OEMs settled near to the region (KIA and Hyundai in the neighbouring Czech city Ostrava). Based on the activity of the regional development agency a cluster organization was established in the ICT branch. The activity of this young cluster initiative concentrates on establishing linkages among ICT firms and local educational institutions. The cluster has

only 7 business members, and given the low size of this industry in general, it is not very likely that it would reach a critical mass that would be necessary for self-sustaining, independent functioning.

On the other hand, more recent calculations of CLUSTER OBSERVATORY (2009) indicated that there is a significant concentration of activity in the automotive sector of Bratislava region. This city has traditionally been regarded as supplier background area of Skoda. During the privatization process of Skoda, also facilities in the later Slovak Republic were sold. Hence VW became a significant investor of Slovakia. Supplier chains were maintained to a large extent like in the Czech parts, also in Slovakia. Thus, a potential automotive cluster is present. Without further in-depth analysis it is impossible to state if the Zilina facilities could join a larger international automotive cluster with the centre in Ostrava, or rather there should be a Slovak "national" automotive cluster merging firms from the Bratislava and Zilina region together. Since however clustering process is influenced by national industrial and regional development policies (top-down development) rather, than by organic bottom-up development process, it is more likely that there will be one main Slovak auto cluster.

As it has already been emphasized, cluster policies do matter in the establishment of cluster organizations. EU made explicit cluster policies even a cornerstone of its industrial policy strategy. Hence, also substantial financial support can be obtained for the purpose of cluster development. This increases governments' appetite for industrial clusters and cluster organizations. Hungarian government moved early into this direction and started with cluster policies already in 1998 (SZANYI, 2001). Other countries of Central Europe did not follow this path (ICEG, 2007), at least up until the first EC budget chapters were not opened up for projects of cluster development. Hence, there are only very few formal cluster organizations in the region, although, their number has increased at high speed during the past 2-3 years. The Hungarian experience clearly showed that there has been a kind on cluster-inflation. Many organizations were established without strong potential background and could not become self-sustaining organizations (SZANYI, 2008a, 2008b). Unfortunately, Hungarian policy never tested a-priori the conditions for cluster development. No systematic cluster mapping was carried out. Even today, responsible authorities rely on the (very questionable valued) CLUSTER OBSERVATORY database. More in depth analysis is sometimes carried out by regional development agencies, but their studies are usually very much biased by strong self-interest.

There is only one systematic database for international comparisons that can compare the spatial concentration of PORTER's traded clusters in the EU region. As concerns automotive and ICT industries, the precondition, the necessary minimum level of size, concentration and dominance only a few locations were found significant. As it is seen in the next table, ICT industry shows significant concentration in three NUTS 2 digit regions in Hungary, and nowhere else in East-Central Europe. The automotive industry seems to be stronger, with three locations in the Czech Republic, two in both Hungary and the Slovak Republic, and one in Poland. If we stick to the earlier strong statement, that a significant threshold level of activity accumulation is precondition of successful cluster development, we can conclude, that most probably there should be one automotive cluster

in each of the four East-Central European countries, and one or two clusters in Hungarian ICT branch.

Table 4: Automotive and IT clusters in East Central Europe*

	Employees	Size	Specialization	Focus	Stars	Innovation	Exports
Automotive clusters							
Severovychod CZ	31578	1,22	3,40	4,80	***	Low	Strong
Strední Cechy CZ	29511	1,14	4,02	5,68	***	Medium	Strong
Zapadne Slovensko SK	21261	0,82	2,03	2,86	**	Low	Very strong
Jihozapad CZ	17203	0,66	2,30	3,25	**	Low	Strong
Közép-Dunántúl H	17091	0,66	2,86	4,03	**	Low	Strong
Nyugat-Dunántúl H	16741	0,64	2,98	4,21	**	Low	Strong
Podkarpackie PL	13367	0,51	2,65	3,75	**	Low	Strong
Bratislavsky kraj SK	11468	0,44	2,79	3,95	**	High	Very strong
IT clusters							
Közép-Magyarország H	30735	1,50	2,27	2,53	**	High	Strong
Közép-Dunántúl H	12535	0,61	2,65	2,96	**	Low	Strong
Nyugat-Dunántúl H	10995	0,54	2,48	2,77	**	Low	Strong

*For methodological descriptions see the prvious table
Source: http://www.clusterobservatory.eu

5. Hungarian cluster mapping evidence

In SZANYI et al (2009) we analyzed the 1998 and 2005 database of the Hungarian Tax Office using PORTER's measurement method, which was described in the previous section. When transforming the industry categories of the database to the one that was defined in the HBS cluster mapping project, we could separate 37 out of the original 38 traded cluster activities[9]. Out of the three measures that were used by KETELS and SÖLVELL (2005) we used only one, the specialization quotient[10]. We found that the

9 For a thorough description of the traded cluster category see: http://data.isc.hbs.edu/isc/index.jsp

10 The design of the locational quotient is similar to BELA BALASSA's RCA measure (revealed comparative advantage). It expresses the relative weight of one single sector in a region to the total weight of the region, compared to either the national economy or a larger geogrphical area. The calculation is as follows:

$$L\,Q_j = \frac{e_{ij} / E_i}{e_j / E} = \frac{s_{ij}}{x_j}, \text{ where}$$

statistical content of other two measures was very much similar. We also found the other two measures strongly biased by the absolute differences between firms, branches and spatial units. Relative concentration is at the heart of the clustering process, and this requires relative measures. Comparisons that are based on the use of absolute values are therefore less applicable, since they reflect size biases.

The calculations were new and more precise in two aspects. We could disaggregate our database in spatial terms from NUTS 2 level (regions) to NUTS 3 level (comitats)[11]. This is important because on regional level important concentrations can be neglected due to differences in terms of varying significance levels of the different economic activities. But finer spatial focus also allows the observation of activity concentrations that do not follow the artificial boundaries of the regions. The other novelty of our calculation method was the usage of various measures of economic activity, not just employment data. We used employment (number of employed persons), number of enterprises, value added and cumulated investment data (investments of the 1998-2005 period). Thus, the final product of the calculations was four measures for each traded cluster branch in each NUTS 3 level spatial unit for the year 2005, and three for the year 1998, since for the starting year no cumulated investment figure was available.

The total number of calculation results was 740 (20 spatial units, 37 branches) for each of the four measures. For an easier overview and better analysis we followed the evaluation method found in KETELS and SÖLVELL (2005). We gave one point for all those branch-comitat pairs that belonged in terms of the given measure to the upper 15 % of the calculation values. Thus, every branch-comitat pair could get maximum 4 points (3 points in 1998)[12]. We considered those pairs where at least two measures proved to be significant (belonged to the highest 15 % and got therefore two points). We also calculated Gini-coefficients. This measure helps us determining whether activity concentration is caused by one or just a few large companies, or rather by a number of medium- or several small sized firms. This is a very important aspect, since we want to measure the pool of potential co-operators, and therefore, the actual size structure is highly relevant for us. The Gini-

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e_{ij} *number of employees in area j in branch i,*

e_j *the total number of employees in area j,*

E_i *number of employees in branch i in the whole country (spatial unit of comparison),*

E *total number of employees in the whole country (spatial unit of comparison),*

Therefore

s_{ij} *shows the share of area j in total employment of branch i,*

x_j *shows the share of area j in total employment.*

11 The database allowed even deeper NUTS 4 level calculations.

12 We also evalated the branch-comitat pairs at a lower 30 % level.

coefficient was calculated from employment figures. Values over 0,9 reflect very uneven structure. If the number of firms (observations) is high (100 or more), then values as high as 0,7-0,8 already indicate that a number of medium sized firms should also be present. Thus, cooperative structures like clusters or supplier networks would have sufficiently broad pool to be based on.

We could spot significant concentration at least in one comitat only in 22 of the 37 traded cluster branches for the year 2005. In the remaining 15 traded cluster branches no branch-comitat pairs received at least two points. The results are summarized in the next table. Interestingly, no services-centred cluster was captured by our calculations, although there is much anecdotal evidence on the existence of even formal cluster organizations based on various services activities (financial services, education, entertainment). Of course, it is possible that this failure is related to the shortcomings of the measurement method. However, the absolute lack of indication in the whole country may also mean that either these clusters operate in an inappropriate environment (too few related companies), or they may be very young organizations that are not yet measurable statistically. In case of the capital city, Budapest a further option is also likely. This city is simply too big and has too heterogeneous business activity that does not allow statistically outstanding concentrations. The large overall size limits the relative importance of sectors that would produce sufficiently large size in many aspects, still, the large denominator makes them unnoticed. Due to this measurement problem Budapest and Pest comitats did not show significant concentrations at all. Since however, we could also provide the total number of firms in the given branch, high values of this data may still deliver the necessary information on spatial concentration.

Table 5: Hungarian cluster mapping results

Sector	comitats	number of firms	Gini-coefficient	qualification	note
Automotive	Győr, Komárom	29; 17	0,81; 0,77	yes	one center
Leather Products	Vas, Baranya, Szolnok, Szabolcs	6; 17; 6; 3	0,66; 0,65; 0,58; 0,66	?	two centers, spatially disperse
Footware	Vas, Baranya, Tolna, Bács-Kiskun, Szolnok, Szabolcs	10, 15; 15; 19; 14; 27	0,64; 0,70; 0,56; 0,54; 0,73; 0,67	?	two centers, few firms
Processed Food	Bács-Kiskun, Csongrád, Békés, Szabolcs	262, 135, 141, 201	0,78; 0,85; 0,79; 0,79	yes	two centers
Building Fixtures, Equipment and Services	Veszprém, Komárom, Nógrád	238; 319; 119	0,82; 0,76; 0,68	yes	one center
Furniture	Zala, Vas, Győr, Békés	170; 124; 186; 117	0,71; 0,78; 0,81; 0,73	yes	two centers
Metal Manufacturing	Fejér, Nógrád	179; 49	0,91; 0,75	yes	two centers
Motor Driven Products	Zala, Szolnok	62; 63	0,80; 0,86	yes	two centers
Biopharmaceuticals	Hajdu	6	0,82	?	one center, few firms
Communications Equipment	Nógrád, Heves, Szolnok	18; 30; 36	0,79; 0,89; 0,89	yes	one center
Aerospace	Heves	3	0,57	?	one center, few firms
Agricultural Products	Veszprém, Baranya, Bács-Kiskun, Borsod	61; 59; 141; 93	0,81; 0,73; 0,65; 0,76	?	three centers, dispersed activities
Plastics	Bács-Kiskun, Borsod	106; 74	0,78; 0,87	yes	two centers
Analytical Instruments	Pest	87	0,77	yes	one center
Medical Devices	Hajdu	57	0,83	yes	one center
Publishing and Printing	Komárom	16	0,73	?	one center dispersed activities
Apparel	Vas, Békés, Hajdu	40; 54; 115	0,76; 0,68; 0,89	yes	two centers
Spőorting, Recreational and Children Goods	Baranya, Nógrád	17; 6	0,61; 0,75	?	one center, few firms
Information Technology	Veszprém, Komárom, Baranya, Pest	13; 25; 23; 127	0,77; 0,91; 0,94; 0,92	?	quickly changing spatial location
Construction Materials	Veszprém, Békés	12; 10	0,84; 0,63	no	one center dispersed location
Chemical Products	Vas, Borsod	5; 18	0,70; 0,70	no	one center dispersed location
Lighting and Electrical Equipment	Tolna	6	0,62	no	dispersed location , few firms

Source: author's calculations

As is seen in the table and also on the amended maps, in many cases we included several comitats together to form a potential cluster. This idea stems from the logic that the spatial dispersion of clusters should not necessarily follow administrative boundaries. The lower spatial observation level (i.e. NUTS 3) allows us to better localize the potential spread of clusters in neighbouring comitats. We treated comiata-branch pair, that showed significant concentration on 15 % level as gravity centres and added to them those neighbouring comitats that showed concentration on at least 33 % level. In some branches we could identify 2 in some cases even 3 centres, the nucleus of potential cluster formations[13]. Such examples are presented on the amended cluster maps. The last two columns of the table provide an evaluation of the branch-comitat pairs concerning the likelihood that they may become real clusters. Whenever we made objections, these are included in the last column, Too wide spatial dispersion, too few companies present were the usual objections.

15 concentrations were found to be strong enough to form clusters. In many cases cluster organizations work already in these centres. In another 14 cases we put a question mark indicating that either strong concentration was not supported by sufficiently high number of potential cooperating firms, or because the relatively strong counties were not in each others close neighbourhood, that would have limited frequent personal contacts of cluster members, which would be also an important aspect of successful cluster operations. In a few cases we found that the original traded cluster categorization was not perfectly suitable for the Hungarian economy. For example, in the case of the branch "agricultural products" Porter's original category included all types of farm products, including the crops, animal products, but also equipment repair and other services. This is highly relevant for large and complex American farms, but does not really apply for much smaller, more specialized Hungarian producers. In this case another categorization could have reflected more precisely those activities along which Hungarian agricultural producers could potentially cooperate.

Summing up the lessons of our cluster mapping exercise we can draw some important conclusions. It is necessary to highlight that most spatial concentrations (potential clusters) are located in areas where there similar industrial activity had been carried out before the transition. This means, that despite of the tremendous structural changes of the two decades of transition, some basic characteristics of spatial and activity structure of the Hungarian economy remained in place. This is an important evidence that supports an important aspect of the cluster-related literature, namely that there is strong path-dependency in economic development. Path dependency also means, however, that cluster policies can and should not be treated as means of a new "capitalist industrialization". The main aim of clustering is to further develop traditional regional strength in order to gain regional competitiveness. We do not want to deny the possibility of creating new structures on the long run. Actually, in the case of automotive industry and ICT production development in Hungary by far exceeded previous levels. In these cases existing capacities

13 We must notice here again, that spatial concentration is just one important condition of cluster formation. Hence, even if we call the observed concentrations clusters or potential clusters, it does by no means mean that there is an actual cluster organization present. HBS documents, as well as the EUROPEAN CLUSTER OBSERVATORY also uses the term „cluster" for spatial activity concentrations.

and expertise played relatively little role. However, these cases seem to be more the exception than the rule.

Another interesting result of the survey follows from the previous argument. We found ample evidence on the existence of activity concentrations in branches and regions which have strong FIE influence, like the automotive and ICT sectors. There is much empirical evidence that shows the impact of important supplier networks[14]. Strengthening the clustering process in such vertically integrated networks would require support for horizontal linkages among cluster members. However, we also found branches where FIE involvement was much weaker. We can conclude therefore, that cluster development in such regions and branches where there is no FIE dominance is also possible. But the structure and functions of these clusters may be very much different. They have stronger horizontal cooperation and less vertical. Also, the power relations are different in such clusters[15]. In this second type of clusters the main activity is rather small business- and regional development. This variation of cluster types calls for more refined and not uniform solutions in cluster development policy.

14 For car industry and the role of PANAC, the Hungarian automotive cluster see: GROSZ, 2006.

15 For evidence and case studies see: SZANYI, 2008

6. Conclusions

1. The concept of industrial clusters is different, most importantly broader than that of multinational firms' supplier networks. The latter can form the nucleus of a potential cluster, but this is the case only if certain conditions, most importantly horizontal linkages as well as a heterogeneous structure of collaborating actors is provided.
2. The spatial concentration of supplier networks around multinational companies is reflected in the cluster mapping exercise. Therefore, one of the most important precondition of forming a cluster, achieving the critical mass is usually given in the vicinity of the largest investments. Foreign firms however are neutral at best concerning the organization of networks among suppliers. Their primary interest is organizing the supplies chain's smooth cooperation.
3. Foreign companies can be made interested in contributing to the work carried out within clusters. Their primary interests in cluster activity is improving regional labor force supply, enhancing suppliers' technical capabilities. They are of course also interested in fiscal incentives. The cluster literature lays great emphasis on big firms' essential role in successful cluster operations.
4. Clusters may evolve however, without the participation of foreign multinationals. In certain industries and markets SMEs enjoy substantial advantages and big firms are not strong. Clusters are not reserved for technology intensive manufacturing activities (where multinationals are strong). Cluster organizations may be valuable drivers of regional economic development which is based on more traditional activities. An important aspect of such clusters is path dependency: traditional local competitive advantages are at their bottom.
5. Despite of the role of path dependency, structural changes that the new techno-economic paradigm carries provide opportunities for emerging market economies to take new roles in international labor division. This relates mainly to most globalized industries and services, where global sourcing has produced massive relocations in the recent past.
6. Nevertheless, neither multinational firms' penetration in emerging market economies, nor cluster development can / must be treated as a tool of "capitalist industrialization". Development (industrial) policy shall continue focusing on improving economic conditions and the sources of future growth and prosperity.

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