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THE LABOR MARKET IN INDUSTRIAL CLUSTER ANALYSIS

Abstract

The paper offers a description of methodologies used in industrial cluster analysis in conjunction with the labor market analysis. Human resources play a significant role in the cluster concept; the type of region's industry, the type of developed products and the rate of technology diffusion depend on the qualifications, the efficiency, the flexibility and the age of the workforce. Besides, both a cluster and human capital are considered to be one of the main drivers of regional competitiveness. The author explores many tools utilized in cluster identification: quantitative methods (LQ, shift-share), qualitative methods (MSQA) and mixed tools (cluster analysis in conjunction with discriminant analysis, spider diagram, GEM model, network analysis). Each tool is described in terms of its connection with the labor market. The author focuses on regional specialization, employment growth and decline, productivity of labor, wage, and salary structure. Moreover, the author emphasizes the role of tacit knowledge, personnel mobility and face-to-face contacts. These kinds of interactions and networking capabilities of people, based on trust and network are keys to implement and adapt new technology.

Key words:
Econometric and Statistical Methods (C4);
Demand and Supply of Labor (J2);
Transactional Relationships; Contracts and Reputation; Networks (L14);
Technological Change; Research and Development (O3);
Regional Migration; Regional Labor Markets; Population (R23)

Competitiveness at the micro and macro level

Nowadays economic competitiveness is not only used in conjunction with individual business firms (the micro-economic level) but also in conjunction with the economic performance of whole industries (at industry level) and countries (the macro-economic level).

At the micro-level, competitiveness means the ability of firms to meet the requirements of an open market in terms of price, quality and term. A firm's competitive advantage can derive from various sources like lower cost, superior services, or superior products. According to Porter success at micro-level is driven by two types of competitive advantages: lower cost and product differentiation (Porter, 1980).

Competitiveness at the industry level is concentrated on the performance of an industry and is based on comparing all firms in an industry of one region with those in the rest of the the world.

Territorial competitiveness is more difficult to define. Regions don't compete with each other like enterprises; they are different and they don't offer the same products. However, national (regional) competitiveness is very connected with competitiveness of the companies localized in this country (region); territorial competitiveness is built on the competitiveness of firms which operate within the borders of a given territory.

In the mid-1980s, the US President's Commission on Industrial Competitiveness issued its report providing a definition of a nation's competitiveness. He described it as "the degree to which it can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously expanding the real incomes of its citizens. Competitiveness at the national level is based on superior productivity performance and the economy's ability to shift output to high productivity activities which in turn can generate high levels of real wages. Competitiveness is associated with rising living standards, expanding employment opportunities, and the ability of a nation to maintain its international obligations. It is not just a measure of the nation's ability to sell abroad and to maintain trade equilibrium" (The Report of the President's Commission on Competitiveness, 1984).

Territorial competitiveness is a very important issue in the European Union. According to Lisbon European Council, the European Union will become the most competitive and dynamic knowledge-based economy in the world over the decade, capable of sustainable economic growth with more and better jobs and greater social cohesion. The European Commission defines competitiveness as "the ability to combine growth with balanced trade'' or "the ability to increase or to maintain the living standard relative to comparable economies (e.g., developed industrialized countries), without long run deterioration of external balance" (European Commission, 94; 95). According to the European Commission "an economy is competitive if its population can enjoy high and rising standards of living and high employment on a sustainable basis […] the level of economic activity should not cause an unsustainable external balance of the economy nor should it compromise the welfare of future generations" (European Commission, 1998; 2001).

OECD developed very similar definitions of competitiveness: "the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining opposed to international competition, relatively high factor income and factor employment levels'' and national competitiveness: "the degree to which, under open market conditions, a country can produce goods and services that meet the test of foreign competition while simultaneously maintaining and expanding domestic real income" (OECD, 1995; 1992).

The main drivers of regional competitiveness: human capital and a cluster

Clusters and human capital are considered to be one of the main drivers of regional competitiveness. The Cluster concept is based on Alfred Marshall's "industrial districts"- defined as agglomerations of firms operating in one industry sector in a well-defined and relatively small geographic area (Marshall, 1925).

During the last ten years, there has been increased interest in the role of industrial clusters. According to Porter an industrial cluster is "a geographic cooperative group that includes suppliers, consumers, peripheral industries, governments, and supporting institutions such as universities" (Porter, 1990; 1998; 2000). Hill and Brennan define an industrial cluster as "a system that causes component firms and institutes to generate higher unit earnings and more efficient operations owing to innovations stimulated by intense competition and cooperation within clusters" (Hill et al, 2000). Padmore and Gibson emphasize interaction within the cluster. They define cluster as "a concentration of firms that prosper because of their interaction, whether that is through competition or cooperation, or by serving as suppliers or customers in the value-chain" (Padmore et al, 1998).

In the related literature there are various cluster definitions developed by economic geographers, industrial and regional scientists. Each of them notes the following characteristics of industrial clusters:

- concentration of SME (small and medium enterprises);
- the enterprises that are rather homogeneous and that have common culture;
- strong linkages between the enterprises (they are cooperators as well competitors);
- innovative environment;
- sharing resources jointly.

According to Porter a cluster's strength is determined by several interacting factors that are grouped into four headings called Porter's diamond. These are: context for firm strategy and rivalry, demand conditions, related and supporting industries and factor conditions (Porter, 1990). All these determinants create an environment for developing enterprises as well as ensuring proper conditions for gaining knowledge. The last one includes factors connected with the labor market, namely high quality human resources; especially scientific, technical, and managerial personnel (see the figure 1).

However some researchers consider Porter's diamond is incomplete and need verification (Fitzgerald, 1994). They argue it is home-based concept doesn't include multinational activities; therefore it's useful for analyses in the national level (Moon et al., 1995, 1998). Singleton, in turn, maintains the diamond model is not enough to explain what exactly determines the competitive advantage of one nation (Singleton, 1997).

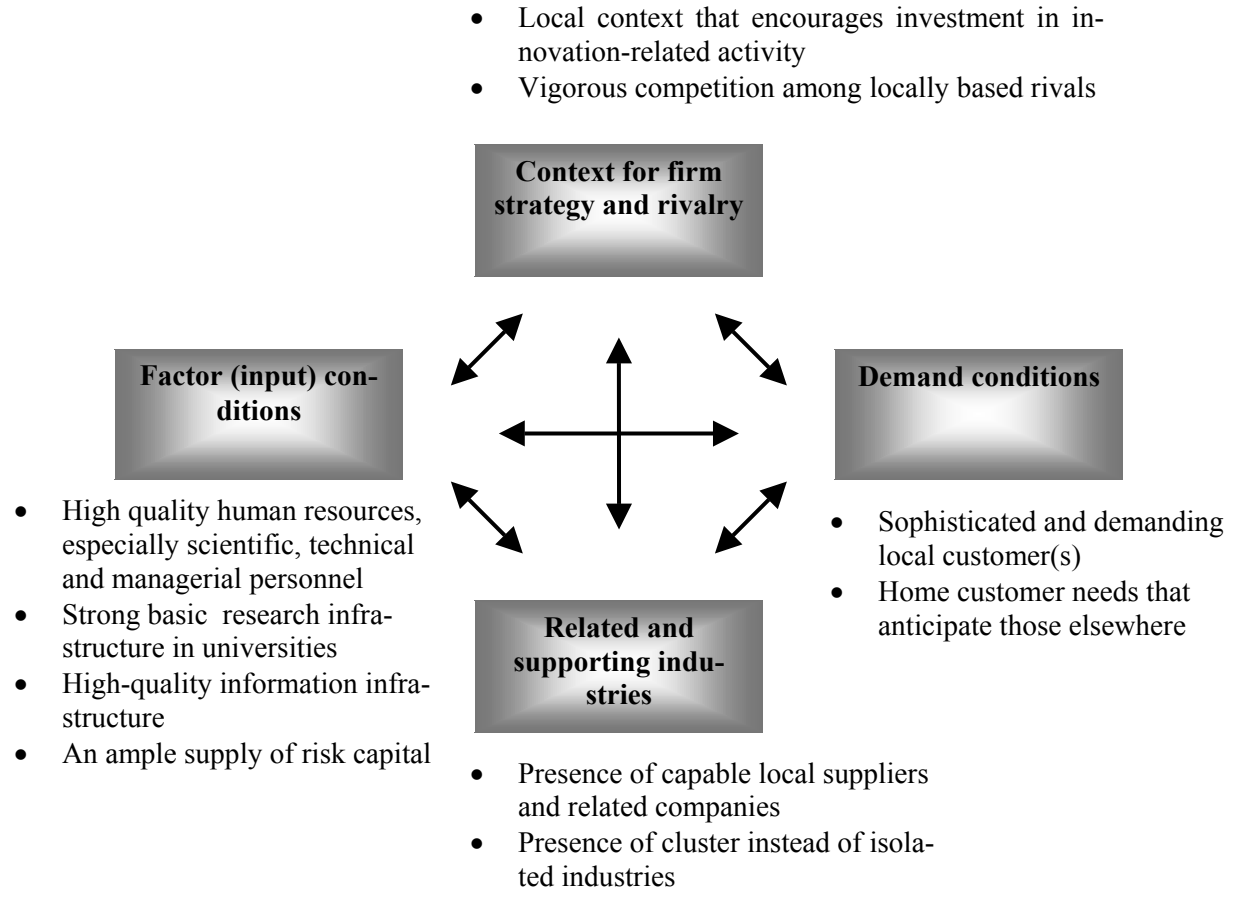

Figure 1. Porter's diamond
Source: M.E. Porter, (1990), The Competitive Advantage of Nations, Free Press, New York, p. 263

Padmore and Gibson also emphasize the role of human capital in the development of clusters. Their GEM model (Groundings-Enterprises- Markets) includes factors very similar to Porter's diamond (Padmore et al, 1998). The GEM model was created to assess the potency and effectiveness of a given cluster by scoring each of six determinants:

- supply determinants (Groundings)- resources, infrastructure;
- structural determinants (Enterprise)- supplier and related industries and firm structures, strategies and rivalry;
- market determinants (Markets)- local markets and access to external markets.

These determinants are arranged in a hexagon, with scores from 1 to 10 attached to each of them on the basis of benchmarking regions (the information derived from economic development authorities, industrial consultants or date basement). Then, by using the following formula GEM score is assessed:

$$GEM = 2{,}5(\prod_{i=1.3}(D_{2i-1} + D_{2i}))^{2/3}$$

The ideal region with great cluster potential would gain GEM=1000[1]; a neutral, marginally competetive cluster would have GEM=250. In the table below there is a short description of each determinant.

Table 1. GEM determinants: Groundings-Enterprises- Markets

Groudings- supply determinants	**Resources**	**Infrastructure**
	natural, inherited, developed endowments within the region- strategic geographical location, forest, mineral deposits, land, labor supply, financial capital, technology	physical, institutional arrangements that facilitate access to resources and support other business functions- roads, pipelines, ports, communications, business associations, research laboratories, training system, tax and regulatory regime, national monetary policy, financial markets, business environment, quality of life
Enterprises- structural determinants	**Supplier and related industries**	**Firm structures, strategies and rivalry**
	success factors include diversity, quality, cost and proficiency of the local suppliers as well as the quality of the buyer-seller relationships	the firms in the cluster itself in the value chain- number and size of firms, birth and death rates, ownership and financial strength, competitive, growth strategies
Markets- demand determinants	**Local markets**	**Access to external markets**
	markets within the region- size of the market, market share, growth and prospects, extent of local sourcing by purchasers, standards and quality expected, distinctiveness of local demand, willingness of buyers to work with the local clusters	closeness of markets, closeness of markets, their size and growth rates, global market share for the cluster, characteristics of end users, existing market relationships, barriers to entry, trade and export barriers

Source: own compilation based on T. Padmore, H. Gibson, (1998), Modeling Regional Innovation and Competitiveness, [in:] Local and Regional Systems of Innovation, de la Mothe J., Paquet G. (ed.), Kluwer Academic Publishers, Boston/Dordrecht/London

[1] GEM = 2,5*[((10+10)*(10+10)*(10+10)] $^{2/3}$ =2,5*400 = 1000

The methods described below are used in cluster analysis. All of them include labor force analysis, e.g. analysis of regional specialization, labor market pooling, knowledge spillovers, informal contacts, trust-based effects, personnel mobility, training, labor relations, wage and salary stucture as well as labor's productivity.

Regional specialization: location quotients

One of the most common methods in identifying regional industry clusters and establishing regional specialization is the location quotient LQ (Isard, 1998); (DTI, 2001). This technique allows us to compare the local economy with a reference economy. The reference area is usually a country, but it can also be a state, a metropolitan area, or a province. An LQ is based upon a calculated ratio of the local industry's actual percentage of total local employment to the percentage of the national industry's percentage of total national employment (see below):

$$LQ = \left(E_{ir}^{t} / E_{r}^{t}\right) / \left(E_{in}^{t} / E_{n}^{t}\right) \text{ where:}$$

E_{ir} -regional (local) employment in industry i in year t;
E_r - total regional (local) employment in year t;
E_{in} - national employment in industry i in year t;
E_r - total national employment in year t.

If an LQ is equal to 1, then the local economy has the same share of employment in industry i as the reference area as a whole. An LQ greater than 1.25 indicates an industry with a greater share of the local area employment than is the case in the reference area - it is evidence of a regional specialization in a given sector.

A location quotient can help us better understand the local economy. Moreover, it is easy and inexpensive to calculate but it doesn't show the linkages within a cluster. Therefore it should be used in conjunction with qualitative methods.

Changes in employment growth - shift share analysis

Shift-share analysis is one way to account for the competitiveness of a region's industries and to analyze the local economic base. This technique provides a picture of how well a region's mix of industries is performing and how well individual industries are doing. There are three components to the total change in local employment for a given period of time: national growth, industrial mix, and competitive share (see below).

$$\Delta E_{ir} = NS_{ir}^{t} + IM_{ir}^{t} + RS_{ir}^{t}$$

Table 2. Components in shift-share analysis

National Growth Component	$NS_{ir}^{t} = \sum E_{ir}^{t-1} \times \left(\frac{E_{n}^{t}}{E_{n}^{t-1}} - 1 \right)$
The national growth component is calculated by multiplying the total local employment (in a given industry) at the start of the time period under consideration by the national average rate of growth for all sectors. This factor describes the change that would be expected if employment level of the industry grew at the same rate as the national economy during the time period under consideration.	

Industrial mix	$IM_{ir}^{t} = \sum E_{ir}^{t-1} \times \left(\frac{E_{in}^{t}}{E_{in}^{t-1}} - \frac{E_{n}^{t}}{E_{n}^{t-1}} \right)$
The industrial mix component is calculated by subtracting the national average growth rate for all industries from the national growth rate for the industry under consideration, then multiplying this result by the local employment (in a given industry) at the start of the time period under investigation. This component shows the change in a local industry that would be attributable to the change of the industry nationally. A positive IM suggests the region has employment concentrated in sectors growing faster than the national economy as a whole.	
Competitive share	$RS_{ir}^{t} = \sum E_{ir}^{t-1} \times \left(\frac{E_{ir}^{t}}{E_{ir}^{t-1}} - \frac{E_{in}^{t}}{E_{in}^{t-1}} \right)$
Competitive share is calculated by multiplying the total local employment (in a given industry) at the start of the time period under consideration by the margin between the local sector growth rate and the national average growth rate for that sector. This component describes how firms in theregion performed relative to national averages for firms in those same industries. A positive RS means the region increased its share employment in that industry	

Source: own compilation

The results of shifts-and-shares analysis provides a representation of changes in employment growth or decline and helps identify strength and weakness in the local economy, particularly in the regional labor market. The sum of these three components of shift share equation represents the structural shifts (the total change in industry employment). Similarly to LQ, shift-share should be used in combination with other – qualitative methods.

Human factor as a core competency in multi-sectoral qualitative analysis

Multi-sectoral qualitative analysis is a tool developed by Stough, Stimson, and Roberts (Stough et al, 1997); (Roberts et al, 1998) for assessing the competitiveness of regions, particularly in four main areas:

- core competencies and resource competitiveness;
- economic possibilities;
- trade possibilities;
- regional economic risk.

When considering the regional labor market the most important is the first area: *core competencies and resource competitiveness*. Core competencies give a region a competitive advantage and they are defined by authors as "a bundle of skills and technologies within a physical resource base that are synthesized to produce distinctive streams of skills, technology and knowledge". Core competencies are the combination of 34 various factors, e.g. technologies, skills, resources grouped in the eight categories: domestic economic strengths, trade orientation, technology and development, finance, management, governance, infrastructure and human resource development. All the criteria in the table below are core competencies, with special emphasis on *human resource development*- connected with the labor market (underlined).

Table 3. Human resource development in MSQA

I. Domestic economic strengths	II. Trade orientation	III. Technology and development	IV. Human resource development
1. Performance of industry sector 2. Dynamism of economic activity 3. Value adding activities	1. Performance of trade and investment 2. Participation in the international economy 3. Openness to foreign business 4. Proximity to markets 5. Strategic business alliances	1. Expenditure on research and development 2. Agglomeration of expertise 3. Collaborative research 4. Technology absorption rate	1. Higher education & training services 2. Skill base 3. Labor relations 4. Quality of life 5. Wage and salary structure
V. Finance	**VI. Management**	**VII. Governance**	**VIII. Infrastructure**
1. Capital base 2. Availability of finance	1. Customer service and product quality 2. Networks associations 3. Business efficiency 4. Marketing capabilities 5. Utilization of information systems 6. Entrepreneurship	1. Regulatory encumbrances 2. Business climate 3. Delegation and local autonomy 4. Business support schemes	1. Resources 2. Energy costs 3. Adequacy and flexibility of infrastructure 4. Transport costs 5. Environmental & waste management

Source: own compilation based on B. Roberts, R.J. Stimson, (1998), Multi-sectoral qualitative analysis: A tool for assessing the competitiveness of regions and formulating strategies for economic development, Annals of Regional Science, 32.

All the criteria are assessed with this scale: strong (S) - 3 points, average (A)-2 points or weak (W)-1 point for each industry sector. The assessment is done with using information derived from I/O table data, focus groups, interviews with regional specialists, economic reports, and local knowledge. The obtained scores are graphed, then summed vertically and horizontally and shown in the two indices:

- A Sector Industry Competence Index;
- A Regional Core competence Index.

Both of them describe the weaknesses and strengths of a region's economy. The first indicator is based on the sum of the scores in the columns and shows the core competencies of each regional industry sector. The second index is built by the sum of the scores in the rows and presents the level of development of each core competency criteria in the region.

Except for core competencies and resources the labor market is analyzed in another MSQA area: regional economic risk. A risk assessment is essential to protect regions from competition and changes inter alia in social instability. In economic risk analysis there are 30

criteria in five groups, assessed in the scale 1-5[2]. In the group „industry risk" there are two criteria connected with the labor market: labor market shortages and managerial skills and capabilities (see the table below). The results of risk analysis are an industry risk index and a regional risk factor index.

Table 4. Human factors in regional economic risk in MSQA

I. External risks	II. Industry risk
1. Exchange rate 2. Global economic & political stability 3. Diplomatic relations 4. Removal of tariff/protection 5. Foreign trade barriers 6. Price stability 7. New technology 8. Communications 9. International competition	1. Continuity of supply of materials 2. Disruption to transport/distribution 3. Disruption to public services 4. Labor market shortages 5. Stability of industrial relations 6. Accessibility to capital 7. Increase in taxation/government charge 8. Accessibility to natural resources 9. Managerial skills and capabilities 10. Rigidity to change of business culture 11. Quality of product or service

III. Governance	IV. Environment	V. Community relations
1. Stability and competence of government 2. Legislative & regulatory change 3. Dependency on public funds 4. Support of government	1. Loss of environmental quality 2. Natural disaster and disease 3. Environmental change 4. Resource depletion	1. Community attitudes to industry 2. Impact of pressure groups

Source: own compilation based on B. Roberts, R.J. Stimson, (1998), Multi-sectoral qualitative analysis: A tool for assessing the competitiveness of regions and formulating strategies for economic development, Annals of Regional Science, 32.

Other indices produced by MSQA include a regional inter-industry opportunity index based on linkages between industry sectors, a matrix of industry export potential, an index of potential export industry development and an index of export market potential for each export market region.

The labor market analysis in conjunction with cluster and discriminant analysis

In cluster analyzes there are used also some combining tools. One of them is cluster analysis in conjunction with discriminant analysis- a method developed by Hill and Brennan for identifying the drivers of a region's most competitive industry clusters and establishing their relationship with supplier and customer industries (Hill et al, 2000). These analyzed industries are called driver industries because they drive regional economy.

Described methods combine cluster analysis with discriminant analysis, using variables derived from economic base theory and the concept of competitive advantage. Although in both forms of analysis the same body of data is used, the cluster analysis is a mathematical tool for identifying various groups of similar industries in terms of their economic base cha-

[2] 5=very significant, 4 =significant, 3=limited impact, 2=minor impact, 1=insignificant

racteristics. Discriminant analysis is a statistical procedure for distinguishing these industries.

In the cluster and discriminant analyses four sets of variables are analyzed: measures of competitiveness, export orientation, centrality in the regional economy, and employment specialization.

- Competitiveness
  - Productivity proxy (estimated gross metropolitan product per hour)
  - Regional industry's change in national employment share
  - Relative earnings: local average earnings to national average earnings
  - Change in relative earnings
- Exports
  - Share of industry's output shipped out of the region
  - Share of local exports accounted for by the industry
- Centrality
  - Forward linkage (buy relationships)
  - Backward linkages (purchase relationships)
  - Change in local employment share
- Employment specialization
  - LQ
  - Change in LQ

From the point of view of the labor market the most interesting are the first, the third and the fourth variable: *competitiveness*, *centrality* and *employment specialization* (see the table below).

Table 5. Labor market factors in cluster analysis in conjunction with discriminant analysis

Competitiveness	
Productivity proxy, gross state product per estimated hour worked	$PROD_i = \{(GSP_t)*[(P_{iS}/P_{ts})*(P_{iR}/P_{iS})]\}/ h_{iR}$, where $h_{iR} = H_i*50*e_{iR}$
Regional industry's change in national employment share	$\Delta N_i = (e_{iR}/e_{iN})^{95}–(e_{iR}/e_{iN})^{89}$
Relative earnings (RE), ratio of local average earnings to national average earnings	$PEP_{iR}^{95}=(P_{iR}/e_{iR})^{95}$ and $PEP_{iN}^{95}=(P_{iN}/e_{iN})^{95}$ $RE_i^{95}=(PEP_{iR}/PEP_{iN})^{95}$
Change in relative earnings (ΔRE)	$\Delta RE_i=(PEP_{iR}/PEP_{iN})^{95}–(PEP_{iR}/PEP_{iN})^{89}$
Centrality	
Change in local employment share	$\Delta L_i = (e_{iR}/e_{tR})^{95}–(e_{iR}/e_{tR})^{89}$
Employment Specialization	
Location quotient (LQ)	$LQ_i =[(e_{iR}/e_{tR}) / (e_{iN}/e_{tN})]^{95}$
Change in LQ (ΔLQ)	$\Delta LQi=[(e_{iR}/e_{tR})/(e_{iN}/e_{tN})]^{95}–[(e_{iR}/e_{tR})/(e_{iN}/e_{tN})]^{89}$

GSP=gross state product
P=payroll
e=regional employment
h=estimate of the number of hours worked
E=national employment
Y=total output
X=total exports
m=multiplier
i denotes the three-digit SIC industry
R denotes the region, S denotes the state, N denotes the nation

Source: own compilation based on E.W. Hill, J.F. Brennan, (2000), A methodology for identifying the drivers of industrial clusters: the foundation of regional competitive advantage, Economic Development Quarterly 14 (1).

In order for some industries to be called the driver industries they have to have high levels of productivity, strong specialization (large LQ) and the region of their localization should have an increasing share of national employment in that industry. Except for the driver industries export a large fraction of their products, they ship a disproportionate share of the region's exports and they have relatively large forward and/or backward multipliers.

Tha labor market in spider diagram

The next combining tool for cluster analysis are spider diagrams (see the figure below) and indexes (Stough et al, 2000).

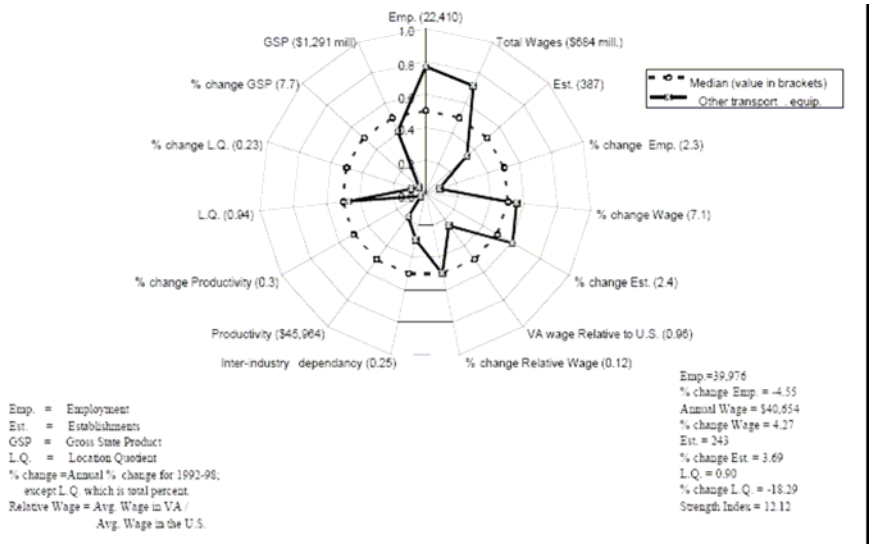

Figure 2. Transportation Equipment Manufacturing Sector in Virginia: 1998
Source: R.R. Stough, P. Arena, R. Kulkarni, J. Riggle, M. Trice, (1999), Industrial cluster analysis of the Virginia Economy, The Institute of Public Policy, Georga Mason University, Fairfax, p. 5.

In this technique every cluster is represented by fifteen economic performance indicators; the majority of them have strong connection with the labor market (underlined):

1. Employment (S);
2. Employment change (P);
3. Total wages (S);
4. Rate-of-change in total wages (P);
5. Establishments (S);
6. Rate-of-change in the number of establishments (P);
7. Wage level relative to the national industry wage level (R);
8. Rate of change in relative wage (D);
9. Inter-industry dependency (R);
10. Productivity (R);
11. Rate-of-change in productivity (D);
12. Contribution to gross state product (S);
13. Rate-of-change in contribution to gross state product (D);
14. Location quotient (R);
15. Change in location quotient (1992-1998) (D).

The assessment of these indicators allows us to describe four basic development parameters of every cluster: scale (employment, total wages, establishments, contribution to gross state product), performance (employment change, rate-of-change in total wages, rate-of-

change in the number of establishments), robustness (wage level relative to the national industry wage level, inter-industry dependency, productivity, location quotient) and growth dynamics (rate of change in relative wage, rate-of-change in productivity, rate-of-change in contribution to gross state product, change in location quotient). On the basis of these indicators we construct spider diagram, cluster strength index, a change index and a form index. The better value indicates, the larger the index value and the larger and stronger the cluster.

Personel mobility- network analysis

A very common method in identifying industrial clusters is network analysis. According to the methodology OECD cluster analysis focuses on four types of knowledge and information flows: interactions among companies, interactions among enterprises and research institutions (like higher education institutions, public and commercial research institutes), diffusion of knowledge and technology, and personnel mobility (OECD, 1997). The most popular data sources are trade or innovation-based input-output tables, patents, strategic partnerships, focus groups, and interviews.

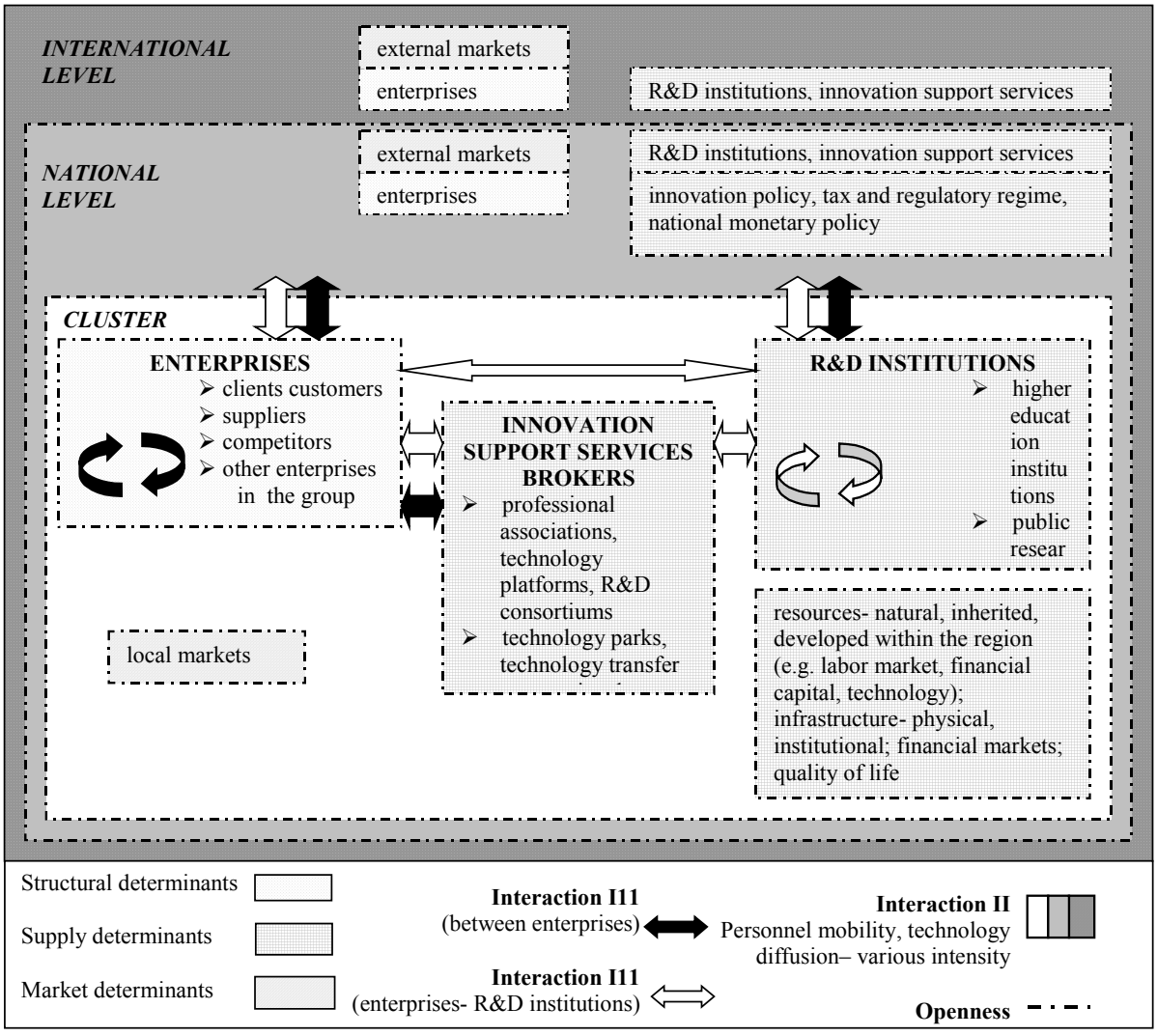

Figure 3. Knowledge and information flows within a cluster
Source: own compilation

From the point of view of the labor market the most interesting is the last flow of

knowledge: personnel mobility. It is based on the movement of people and the knowledge they carry with them and it is often called "tacit knowledge". The knowledge can be obtained by companies through inside contacts (within the company) as well as outside contacts (e.g. horizontal and vertical flows between enterprises and other institutions within a cluster, consulting). In the table below there are samples of the measurement of personnel mobility.

Table 6. Measurement of personnel mobility

Inside contacts	Outside contacts
• employees involved in R&D, in innovation activities, • R&D teams (number of teams, number of members) • time spending by employees in other enterprises in the group (for example- per year) • attendance at education or training programs, conferences, fairs/exhibitions (expenditure, number per year, average number of involved employees- participants) • staff with higher education, percentage of academic scientific staff, percentage of PhD • number of spin-off • number of strategic investors • rotation (average time of employing)	• attendance at education or training programs, conferences, fairs/exhibitions (expenditure, number per year, average number of involved employees- participants) • common projects with other companies, institutions, higher education institutions, public and commercial research institutes, innovation support services (number and value of projects, number of involved employees) • membership in professional associations/ technology platforms/ R&D consortiums (number of organisations, number of involved employees- participants) • number of academic researchers employed in a company • number of students' probations, average duration of every probation • overall percentage of R&D projects involving external partners • number of researchers moving in and out of research institutes

Source: own compilation

Personnel mobility is said to be the most important flow within a cluster; the mobility of the labor force guarantees access R&D staff, information, technology and favors fast technology diffusion. According to most studies of innovation, the skills and networking capabilities of personnel and informal contacts (face-to-face interactions), based on trust and network are keys to implement and adapt new technology.

Conclusion

Human resources play a significant role in the cluster concept as well as in a knowledge based economy. The level of qualification and structure of population in a given region have great impact on the competitiveness of the region. The type of industry and the type of developed product in a region depends largely on the qualifications of the labor force. The quality of human resources is the major factor behind the invention and diffusion of technology.

Innovative firms, R&D institutions and innovation support services within a cluster creates knowledge as well as providing multi-channels of personnel training. On the other hand a cluster invites the best specialists found in a given region with good conditions to ma-

ke a business. It gives access to skilled labor. By improving the quality of human resources the competitive advantage of industry is promoted, opportunities are created for new industries and consequently the attraction of industrial clusters is increased. Except for the quality and accessibility of human resources a cluster's success is determined by the age of the population, entrepreneurial culture, the efficiency and the flexibility of the workforce, the population growth (or decline) and migration flows.

Researchers have utilized a variety of approaches and methodologies in industrial cluster analysis, both quantitative (LQ, shift-share) and qualitative (MSQA). There are also mixed methods being combinations of qualitative and quantitative approaches (cluster analysis in conjunction with discriminant analysis, spider diagram, GEM model, network analysis). All these methods include labor market factors (e.g. employment size, employment change, productivity, relative earnings, total wages, employment specialization). The results of cluster analysis permits us in depth understanding of a region's economy and situation in the labor market.

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