Comparison of Often Applied Methods for Industrial Cluster Identification

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Abstract—The industrial clusters fall into the group of modern tools of economical development for regional economy and competitiveness increasing. When the creator or regional authorities think about the cluster birth, they must have some method how to obtain information about suitability of region for cluster birth, potential of regional economy. There are several methods for industrial clusters identification in regions in contemporary literature. But no more methods are applicable in practice because of the data are not available. Presentation selected methods and their comparison is the goal of this paper. Also the taxonomy and discussion of advantages and disadvantages in practice are the partial objectives.

Keywords—cluster, comparison, economic development, region, taxonomy.

I. INTRODUCTION

The conception of the regional policy and regional development is still an evolving process. The economic growth is the limelight in context of the European regional policy. The main growth determinant is also increasing competition of the municipalities, regions and countries. It can be realized thanks to engines (centres of excellence, clusters) support. These centres are the carriers of the main part of the local and regional economic development. At these levels there are many tools of local and regional development used.

This paper focuses on selected methods for industrial cluster identification in regions, brings the taxonomy of many accesses to this problems. The comparison of the selected methods is not missing.

II. INDUSTRIAL CLUSTERS AND CLUSTER INITIATIVES

The cluster delimitations were objects of many regional scientists’ interests. We present fundamental definitions as follows:

According to [9], the local competition creates incentives to emulate best practice and boost pressures to innovate, while also connecting the strengths of competition with the virtues of selective cooperation. The concept of clusters was related to the “competitiveness” of industries and of nations.

Every operating cluster has some common characteristics [2]:
1) clusters are managed by entrepreneurs and public subjects,
2) the cooperation and competition are fundamental,
3) fixed relations between companies and public administration institutions,
4) cluster is a system where every member is of the same importance,
5) cluster members have the common technologies, customers, distribution channels or labour markets and human capital.

The economic cluster is a geographic concentration of similar, related or complementary companies which have active channels for business transactions, communications and dialogs. They share specialized infrastructure, labour markets and services. The clusters can contribute to the economic growth of both the cluster members and the whole region. This is possible due to following reasons:
1) clusters increase the productivity through the possibility of access to specialized inputs (including human capital), information and institutions,
2) clusters increase innovative capacities (due to competitiveness inside the cluster),
3) clusters stimulate quick production and attract new firms to the cluster,
4) clusters make the regional strategic planning of higher quality possible. This is caused by the knowledge of the entrepreneur environment.

The cluster initiative can be characterized as an organized effort focused on the growth and competitiveness increase in regions thanks to many companies and firms which can be clustered, governments (local and central) and research institutions and communities. Sölvell [12] presents some efficient models of the cluster initiatives and they present cluster initiatives as efforts focused on clusters formation in regions (they are presented by means of policy programmes).

The cluster initiatives represent mostly the prime-stage of the cluster formation. Anderson [1] says: “Cluster initiatives”
are viewed as conscious actions taken by various actors to create or strengthen clusters. There are multiple relevant actors, and they may relate to each other in different ways. Governments and other public authorities are known to be responsible for most cluster initiatives, although there is a marked geographical variation.

Cluster initiatives are characterized as follows:
- every initiative is inimitable,
- initiatives are mostly situated in developed and transforming economies (they are largely connected to high technologies – information technologies, pharmacy, bio pharmacy, medicine, car industry, etc.),
- they are also generally located in innovation-friendly environments,
- the clustered companies, firms and other organizations are geographically nearby.

They used to be the key elements of the industrial, regional and innovative policies, especially in developed countries. They are suitable for “revival” of stagnant industries and also for the revitalization of non-operating clusters. The cluster and innovative potential are the integration of two fundamental part of one Porter thesis “the cluster is presumption of the innovations”. If we define that the cluster existing is the presumption of innovations´ birth, we would like to be able to measure the ability or capacity for cluster existing in regional or spatial framework.

III. METHODS OF INDUSTRIAL CLUSTERS IDENTIFICATION

Many regional scientists (Porter [8-10], Sölvel [12], Bergman, Fesser [2,4], Skokan [11] and many others) patronize the ideas of diversification the identification methods according to the level where the clusters are analyzed. National (macro-level), industrial branch (mezzo-level) and firm level (micro-level) can be recognized.

The mezzo-level was considered as the most important in the 90-th of the 20th century. The clusters are identified in European countries and regions at all levels contemporary. We recommend to diversify also national (state or country), regional (NUTS II or NUTS III) and also local level (municipal or micro-regional). This concept seems to be more suitable in the practice of small European regions.

Porter [8,10] presents the procedure (all in harmony with higher mentioned):
- analysis of cluster identification must start in big firm or firms concentration and continue up of down in vertical chain of firms and institutions;
- the horizontal view is the next step in what the industrial branch is identified. This branch must have the similar characteristics or being complementary products or services producers. The horizontal chain of industrial branch can be identified with the specialized inputs, technologies or similar relations in suppliers’ chain.

For identification of industrial branch and clustered firms Porter sets the institutions what can provide the specialized and qualified labour force, technologies, information, knowledge, capital or infrastructure, some other collective boards also with the actors of cluster. The public administration offices and government representatives finding is the last step. These actors can influence the whole cluster for example with money (grants) from public budget in phase of cluster birth.

Anderson [1] wrote in his paper the list of steps for cluster identification in regions:

1) definition of economical region for analysis. The main of the relations among firms, local government and institutions must be realized in this region. The other type of cluster is defined by actors (not only geographically). These actors can come from other regions, but they are connected with relations inside the cluster;

2) analysis of the economical indicators (unemployment, export, added value, turnover, benefit) in important industrial branch where the concentration can be find. Here the coefficient of specialization or localization (agglomeration) can be used.

3) identification and selection of probable groups in export branches where the relations are identified. The sense of this step is to set group of clustered subjects what can introduced the suppliers of inputs, components and services connected with the main production of the cluster.

4) cluster definition determination is the next step. During this step the interviews with the managers of all actors must be realized because for analyses the various data is needed.

5) cluster map increasing is the next step. The graphical visualization of the industrial branch and relations in cluster in region can be made.

6) function of cluster for the region is the last step. This step can be realized continuously.

For realization of the step No. 3 there are many methods for cluster identification in practice.

Subsequently presented methods for clusters potential identification can be used at macro-level and regional level. The clusters can not be identified in locations with lack of networking and trust. These two premises are the basic conditions of successful clusters. Firms without these conditions are called “conflux” of the firms, no cluster. The better concept than conflux is known as a quasi-cluster.

Following methods for cluster identification were used in various studies [2] so far:
1) Expert examination - it must be based on many detailed information, but does not make a generalization possible,

2) Indexes of specialization (localization coefficient, LQ) – they are frequently used due to easy calculation; these indexes are supplementary only; they are oriented on specific fields; thereupon the result of this method is not fully relevant for cluster formation decision.

Localization coefficients compare the characteristics of branches (number of employees, sales and added value) at the regional and national level. The results of the LQ show the dominant localization of enterprises in the given branches. The localization quotients for the number of employees is defined as follows

\[ LQ_i = \frac{z_i}{Z_i} \cdot \frac{z}{Z} , \]  

where:
- \( LQ_i \) is localization coefficient of the i-th branch (employees),
- \( z_i \) is the number of employees of the i-th branch in a region,
- \( z \) is the total number of employees in the region,
- \( Z_i \) is the number of employees of the i-th branch in country,
- \( Z \) is the total number of employees in country.

\[ LQ_{iv} = \frac{V_i}{V} \cdot \frac{v}{V} , \]  

where:
- \( LQ_{iv} \) is localization coefficient of the i-th branch (turnover, value added)
- \( v_i \) is the value of output (turnover, value added) of the i-th branch in a region,
- \( v \) is the value of output in the region,
- \( V_i \) is the value of output (turnover, value added) of the i-th branch in country,
- \( V \) is the value of output in country.

3) Input-output analysis of business relationships (IOA) - this method can identify the relationships among firms which are necessary for cluster initiatives; the drawbacks of this method are quick obsolescence, low accuracy and the inability of its application in small regions,

4) Input-output analysis of innovations - this method is also known as index of innovative activity; it does not focus on the clusters actually,

5) Network analysis and graph theory - this method is applied as a visualization tool,

6) Statistical and economic compendium - it is actual, but costly; the objectivity of the results interpretation is crucial.

7) Comparative advantages analysis – ratio of regional amount of export in every sector to export of all sectors, this ration must be compared with ratio from compared countries.

Berman, Feser [4] have also own list of methods:
- expert examination,
- specialization indexes,
- input-output analysis for business relations,
- input-output analysis for innovations (unsuitable for cluster identification),
- network analysis, graph theory (rather tool for visualization)
- statistical and economical overviews.

There are many lists of tools for cluster identification in literature and other sources. But if we want to do the taxonomy, we must collect the similar methods and grouped them together. We can use the data sources needed for calculations. Two groups of methods are:
- qualitative,
- quantitative.

Among quantitative methods we can count:
- localization coefficients (LQ),
- input-output analysis,
- shift-share analysis,
- Giniho coefficient of localization,
- Ellison and Glaeser index of agglomeration,
- Maurel-Sédillot index.

Among qualitative methods we can count:
- interviews with experts and management of the firms,
- researches (question-forms),
- case studies.

It is known also the method based on Porter diamond model what is the combination of suitable quantitative and qualitative method (based on the calculations and interviews results). The method of competitiveness advantage analysis is the name of this new method (MCAA).

Among presented methods there are some which integrate in themselves some mechanisms from other methods. The Elison and Glaeser index is a clear example – it integrates geographic concentration, industrial concentration index and Hirschmann-Herfindahl index. That is why we can define some other methods for cluster identification:
- diversity index (RDI) for the measurement of regional industrial specialization according to Duranton and Puga in year 2000,
IV. CHARACTERISTICS AND COMPARISON OF SELECTED METHODS FOR CLUSTER IDENTIFICATION

Input-output analysis\(^1\) (IOA) is one of a set of related methods which show how the parts of a system are affected by a change in one part of that system. Input-output analysis specifically shows how industries are linked together through supplying inputs for the output of an economy.

Input-output analysis is a method used to characterise economic activity in a given time period, and to predict the reaction of a regional economy to stimulation, for example, from increased consumption or changes in government policy.

It uses matrices to describe the way in which the productive system satisfies final demand (consisting of consumption, investments and exports). An input-output matrix represents the links between an economy’s resources and its consumption. The matrix may vary from the simple (three sectors: industry, services and agriculture) to the complex (over 500 branches). It is one of the only techniques applicable to the evaluation of the partial impacts of structural interventions, because it allows for the detailed division of an economy’s productive structure. An input-output matrix can be compared to a macro-economic model that is highly simplified regarding the economic mechanisms represented, but which is extremely detailed from the component point of view.

Input-output matrices are used primarily in scenario analysis and simulation, where they serve to verify policy scenarios, based on the technological structure of the economy of the country and on the state of final demand. They can also be used in forecasting. In an evaluation they can be used with or without policy interventions, in the same way that a macro-economic model can be used (see below). There are numerous applications of input-output matrices to the evaluation of development programmes, including estimating impacts differentiated according to the different branches of an economy.

Shift-share analysis\(^2\) (S-SA) is a technique sometimes used for retrospectively decomposing changes, usually in employment, in a set of urban areas or regions. Regional scientists widely use the technique to examine the sources of employment growth or decline.

We have a study area in which employment and population are growing (or declining: the technique works the same way in either case and it saves words to make the growth assumption.) Total employment in our area is \(e_i\), and that in the \(i^\text{th}\) activity is \(e_{i,t}\). We have a larger frame reference area, usually the nation, where total employment is \(E\), and that in the \(i^\text{th}\) activity is \(E_i\). The shift-share model says that growth in the study area’s \(i^\text{th}\) activity employment is a function of:

- the study area’s share of national (or regional) growth.
- the mix change in activities.
- and the shift change of activities toward the study area.

This says that change in employment in the study area’s \(i^\text{th}\) activity from time \(t\) to time \(t+n\) can be measured:

\[
e_{i,t+n} - e_{i,t} = \text{share change} + \text{mix change} + \text{shift change} \quad (3)
\]

or

\[
e_{i,t+n} - e_{i,t} = e_{i,t} \left[ \frac{E_{i,t+n}}{E_i} - 1 \right] + e_{i,t} \left[ \frac{E_{i,t+n} - E_{i,t}}{E_i} \right] + e_{i,t} \left[ \frac{e_{i,t+n} - E_{i,t+n}}{e_i} \right] \quad (4)
\]

As this brief discussion suggests, shift-share analysis may be viewed as adding explicit considerations to economic base analysis. Economic base analysis asks how an area shares in national growth. Shift-share goes on to look at the changing mix of activities and at whether activities are shifting toward or away from the study area.

Method of competitiveness advantage analysis (MCAA) flows from Porter diamond model which describes the competitiveness model of economical environment in which the cluster exist. The model shows competitiveness in the microeconomic environment of cluster (we can discuss if all components are microeconomic) and its components. These can be analyzed and modelling.

This method is very demanding for input data, but that is the reason for very high interpretation ability. Method can help map the cluster potential in all main industrial branches in analyzed region. The dependence on opinions of managers from regional actors is the disadvantage of the method. It can be removed with big amount of target group.

The method is based on interview with managers or economical workers from firms in region where we can define


the cluster potential. Among the questions there are many questions for opinion on:

- accessibility of specialized sources needed for production in the industrial branch (human, capital, infrastructure, nature),
- relations among the firms in region (aggressive relations, evaluation of entrepreneur climate etc.),
- suppliers chains (suppliers for demanding end customers),
- local subcontractor systems, flexibility of local firms,
- relations among the firms in region and their branch orientation.

Every respondent can evaluate his every answer by 4-point scale (1, 2 – positive; 3, 4 – negative). The result is calculates as difference positive and negative answers. There can be used also the weight of every answer (point weight) and ratio of every group of answer on all. The proportional (%) result expresses the positive or negative position of the result on the graphic tool (tetragon). The focus of the tetragon is -100 %, the extreme of every line is +100 %.

Described methods characteristics are showed with some fundamental characteristics in table 1. The use of only one method of analysis is not enough for cluster potential identification. One method can not describe economic reality in which the clusters birth and exist.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>THE CHARACTERISTICS OF METHODS FOR CLUSTER POTENTIAL ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LQ</td>
</tr>
<tr>
<td>Data</td>
<td>Statistics and databases</td>
</tr>
<tr>
<td>Number of factors</td>
<td>Only 1, but variable</td>
</tr>
<tr>
<td>Factors</td>
<td>Employment, Turnover, or Value added</td>
</tr>
<tr>
<td>Predicative ability</td>
<td>Low (only orientation information)</td>
</tr>
<tr>
<td>Available level of calculation</td>
<td>Local – region – country</td>
</tr>
</tbody>
</table>

From table 1 you can see that some of method can be used only for orientation. These methods can be used for quick orientation (for the first sight). Before the support provision the sufficient predicative method should be used in practice. But there are many obstacles for using the method and calculation the results:

- free data is not available (nor in Statistical Office or Eurostat), you can count with much time for data obtaining;
- I-OA can be used only in national level, the detailed data is not available never;
- S-SA and I-OA are more complicated than for example LQ method,
- the results from qualitative methods are available on the subjective meanings of the respondents. For more objectivity you must use the multivariable statistic methods.

V. CONCLUSION

As shown, the appropriate industrial cluster identification methods are enough. Their use in practice is quite difficult. Trying to maximum effectiveness of public resources which Government provides to support emerging clusters, however, we must also make these complex calculations. And we must know in advance whether a project has a chance to succeed or is an ambitious idea that has no real justification for public money and it would have been wasted.

REFERENCES