Cluster Potential and Innovativeness of Food Industry in European Union Countries

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Abstract

Theoretical considerations and empirical studies show that cooperation within the cluster structures may be the effective method of searching the lasting competitive advantage as well as innovativeness level of food producers. For this reason, the purpose of this elaboration was the evaluation and comparison the strength of food industry clusters identified at the national level of aggregation EU countries with their innovativeness. Spatial identification of clusters in EU countries was based on following measurements: size, specialization and concentration. On this basis the strength of food processing clusters in country was measured. The level of innovativeness of food industry was evaluated on the basis of the percentage of innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities) and the share of enterprises implementing the technology and non-technology innovations in food industry sector.

Keywords: clusters, innovativeness, food industry

Introduction

Concentration of industry activity within the geographic space is not a new thing in the economic sciences. The meaning of localization in gaining the economic success was noticed, by one of the first, Alfred Weber (Theory of industry enterprises localization) and Johann Heinrich von Thünen (agricultural areas). Another major step in studies of territorial competitiveness was the concept by Marshall about the industry districts localized in Great Britain in XIX century. Back there he mentioned that cooperation and trust between people is a significant role in creation of innovativeness of economy and economic operators (Marshall 1920). Local concentration of enterprises is also one of the key features of cluster conception, proposed by Porter (1990). Effects of localization related to spatial concentration of enterprises operating in identical, similar technology or complementary result in creation of character cluster nature structures. The level of concertation of economic activity of food industry subjects is determined by economic potential of sectors in individual regions of EU, which may influence the results of competing. Among basic benefits of operating the enterprises within cluster, are: improvement of productivity and competitiveness (Porter 1998, Delgado at al. 2012). Porter (2001) emphasizes also other positive effects of cluster activities such as: increase of the innovation capacity and forming the new enterprises in sector (especially operators from related and support sectors). Potential possibilities of increasing the innovativeness of enterprises which are within the cluster are pointed out by Martin and Sunley (2003). The studies (Falck et al. 2010, Beule and Beveren 2011), shows that it is connected with stimulation of R+D activity. Processes of creation of new solutions which are

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spreading over more businesses are becoming less costly and risky. Other authors (Hervas-Oliver et al. 2009, Nishimura, Okamuro 2009, Lee 2009) state that only the geographic closeness is not the sufficient premise for the economic operators to make the innovation activity. Important factors are features of the companies and the quality of institutional environment. That is highlighted by Cordes at al. (2015), who claims that the industry of low technology (in which the operators of food industry are included) is strongly connected to the regional properties in location. The competitive advantage and tendency to implement are not developed only inside the enterprise but also depends on usage level of existing strengths in the environment according to the authors. Charlesa et al. (2012) express the view that the chance for expansion of innovative activity is knowledge transfer not only within the regional clusters but also making of interregional and international grid. Agreeing with this thesis in the article it has been accepted according to view of Iritie (2015) that complementary influence of geographic closeness of economic operators and factors of regional surroundings are the major parts of real influence the clusters for enterprise innovativeness which are functioning within the cluster. For this reason, the purpose of this elaboration was to evaluate and compare the strength of clusters of food industry identified on national level of aggregation of EU nations with their innovativeness. The following research hypothesis was adopted: *Between the appearance of strong clusters connected with food industry in EU countries and its innovative position, there is positive correlation.*

**Methodology of Research**

Clusters may be considered by assuming various shots: conceptual, model and analytical. First of them is based on the classic approach from Porter (2008) who defines clusters as “a geographic concentration of related companies, organizations, and institutions in a particular field that can be present in a region, state, or nation”. The second approach cluster is a model concept which reflection is the map of cluster and structure of value chain. In analytical approach the occurrence of geographical aggregation of economic operators is accentuated, which basis is the group of enterprises which have similar industry profile. Extraction of clusters is done on the basis of the severity of occurrence of specific economic activities in the region. In this article the analytical approach of cluster was used, by identifying concentrations of enterprises of food industry in EU countries, by using the tools of concentration and specialization analysis. For spatial identification of clusters in EU countries the following dimensions were taken into consideration: size, specialization and concentration. Such approach is compatible with methodology proposed by European Cluster Observatory (ECO). The database of this organization and European Cluster Collaboration Platform were two of the major data sources of existing clusters in EU countries in 2013.

Problem of selection of appropriate measures which can be used to evaluate the level of innovativeness of sectors in view of the diversity of ways of understanding and its defining is represents a subject of many scientific discussions. In this elaboration, guided by opportunities of access for empirical data, the most actual results of surveys about performing the innovative activities posted by Eurostat in Community Innovation Survey were used (years 2010-2012). As a measure of innovative position of food industry the percentage of innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities) and the share of enterprises implementing the technology and non-technology innovations in this sector, were used.
Indicators of the cluster size and innovative position of economic operators of food industry were base of creation of EU countries classification. It was made by defining so called development pattern – the abstraction country which is characterized by the highest level of aforementioned diagnostic variables. Then the distance of every country from the model was measured according to the formula:

\[ d_i = \sqrt{\frac{\sum_{j=1}^{m} (z_{ij} - z_{0j})^2}{m}} \]

where: \( d_i \) – distance between the country and model, \( z_{0j} \) – maximum value of variable \( j \), \( m \) – number of variables. Obtained results were converted by use of following formula:

\[ W = 1 - \frac{d_i}{\max\{d_i\}} \]

where: \( W \) – level of indicator for adopted cluster size, which are: size, specialization and concentration.

This enabled presentation of data in a way that higher values testify about the more favorable level of analyzed phenomenon (country which is the model is always taking the value of 1). The level of clusters development and innovative position in EU countries were identified by two parameters of taxonomic meter, which are: arithmetic average (\( \bar{x} \)) and standard deviation (\( S \)) of used indicators. They were divided into four typological groups:

1) countries of high level of diagnostic variable: \( W \geq \bar{x} + S \),
2) countries of medium level of diagnostic variable: \( \bar{x} + S > W \geq \bar{x} \),
3) countries of low level of diagnostic variable: \( \bar{x} > W \geq \bar{x} - S \),
4) countries of very low level of diagnostic variable: \( W < \bar{x} - S \).

It allowed to make comparison of dependence between the cluster potential of food industry in different countries with its level of innovativeness.

**Results and Discussion**

Diagnosis of the first dimension of identification and evaluation of cluster agglomeration was about their size. Size of the cluster is connected with number of people hired in this sector within the country in relation to hired people in food processing in EU. It identifies the economic meaning of food industry operators of a country in a scale of whole European. Irregularity of arrangement of generating activity between the countries features economic growth from centuries. Presented data on figure 1 confirm this thesis. It has been identified significant differences of food industry clusters size in countries of EU. Conducted calculations allowed to identify six countries which have big size of food industry clusters. The leader of this group was Germany. Another places were held by: France, Italy, Great Britain, Poland and Spain. Average level of cluster size was noted in Romania. Rest of the countries were included to the group of countries of small size of this sector cluster.
Regional specialization is another indicator of food industry clusters potential. It occurs when examined feature is within the subdivision in the above-average intensity. In situations when level of concentration of economic activity is above the characteristic level for reference area, it may be stated that economic function was developed and therefore area specialization. The basic indicator of regional specialization, and therefore identification of clusters is location indicator (LQ). This indicator, which is a relative measure is also a comparison of share of employment in cluster category to general employment in country according to the identical proportion in reference area (in this case European Union). Therefore, it reflects the intra-regional structure in countries of EU. From this point of view, to the countries of high importance of food industry within the economy of the country in comparison to the whole economy of EU were included: Malta, Lithuania, Romania and Poland (fig. 2). It is connected with above average concentration of the sector in these countries. This is the evidence of their bigger specialization in production of food articles than in other countries. Countries which have medium importance of food industry are: Ireland, Bulgaria, Hungary, Luxembourg, Slovakia and Estonia. The least importance of food industry within the structure of National economy was noted in Spain and Great Britain.

Figure 1. Classification of EU countries according to the size of food industry clusters

Source: Own calculation based on data from Eurostat, European Cluster Observatory and European Cluster Collaboration Platform.
Figure 2. EU countries classification by specialization of food industry clusters

Source: Own calculation based on data from Eurostat, European Cluster Observatory and European Cluster Collaboration Platform

Considering the concentration as a third of analyzed cluster dimensions, the ones which have a participation in employment rate which allows them to be categorized as a group of 10% of the largest concentrations in EU, are taken into consideration. If the index is high value, it means that strength of clusters in sector within a region is big. Carried analysis shows that in case of food industry clusters there is a big convergence between focus index and location indicator. Classification of countries by concentration was identical to the one in case of specialization (fig.3). In the first group the following countries were counted: Malta, Lithuania, Romania and Poland. Countries of medium level of specialization index are: Ireland, Bulgaria, Hungary, Luxembourg, Slovakia and Estonia. In regional economy the smallest meaning of food industry was noted again in Spain and Great Britain.
A sign of actions taken by enterprises of food industry is their innovative activity. The basic measure in such context is percentage of innovative subjects in the global number of enterprises. The group of high level of this indicator consists of: Ireland, Luxembourg, Estonia, Greece (fig.4). Above average level of innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities) was noted also on Malta, in Belgium, Denmark, Lithuania, Germany, Italy, Finland and in Great Britain. It groups of these countries are also the ones which have the highest share in the intra-union export market which are: Belgium, Germany, Italy and Great Britain (Juchniewicz, Łukiewska 2014). These are also countries which have the biggest production potential of food industry among EU countries what is the result of their size.

Figure 3. Classification of EU countries by concentration of food industry clusters

Source: Own calculation based on data from Eurostat, European Cluster Observatory and European Cluster Collaboration Platform
Figure 4. Classification of EU countries by share of innovative active enterprises of food industry
Innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities)

Source: Own calculation based on data from Eurostat, Community Innovation Survey

Another indicator of assessment of the level of innovation of food industry was the share of enterprises implementing technological and non-technological innovations in this sector. Such approach was result of complementary character of listed types of innovations, which allows to get the effect of synergy with innovative activity (Edquist 2001, Lewandowska, Golębiowski 2012). The most of food industry enterprises which implemented technological and non-technological innovations were in Luxembourg, Ireland and Malta (fig.5). The average level of implementing these innovations was noted within 11 countries – the highest was on Malta, and the lowest in France. Definitely the lowest percentage of enterprises operating innovative activity in conducting technological and non-technological innovations was noted similar as to innovation activity in: Hungary, Bulgaria, Poland and Romania.
Cluster structures are effective mechanism of resources concentration and measures of individual entities, thereby favoring the occurrence of synergy effect between them. Conducted earlier studies (Juchniewicz) shows that concentration of economic activity measured by size of the clusters and their number in countries of EU was determining factor for their international competitive position specified by participation in the world export of food. By identifying the influence of dimensions of food industry clusters in EU countries for the level of their innovativeness it was not found any statistical essential depending. Comparison EU countries classification by described indicators allow to form general conclusions about dependencies between analyzed variables. In countries such as: Germany, Italy, Great Britain and France innovative activity of food industry enterprises correlates with economic importance of these operators in Europe-wide scale (tab. 1). It can be stated that main instrument of competition (strengthening their competitive advantage which results from the size of their food industry clusters) is conducting innovative activity. To the group of
countries which have less importance of food industry in EU, but with high percentage of enterprises active with innovations includes: Ireland, Luxembourg, Estonia and Greece. Innovations as an instrument of competing have a less meaning in Poland and Romania. In context of possibilities of competition of these food industry enterprises on the EU market connected with the cluster potential, such situation is not favorable. Cost-price advantages, which are in present the basic aspect of competition of food industry should be in a bigger scale strengthened by conduction the innovative activity.

Table 1. Rozmiar klastrów a aktywność innowacyjna przemysłu spożywczego w krajach UE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Level of the clusters size</th>
<th>high</th>
<th>medium</th>
<th>low</th>
<th>very low</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td></td>
<td></td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>medium</td>
<td></td>
<td>-</td>
<td></td>
<td>Ireland, Luxembourg, Estonia, Greece</td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>United Kingdom</td>
<td>Sweden, Slovenia, Austria, Netherlands, Cyprus, Slovakia</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>verylow</td>
<td>Poland</td>
<td>Latvia, Bulgaria, Hungary</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own study based on figures 1-5

Analyzing the dependencies between the dimensions of the food industry clusters in EU countries and implementing by these countries technological and non-technological innovations, the similar results were obtained. That confirms the former conclusions about the dependencies between cluster dimensions and their innovative activity.

Specialization shapes the structure of production and trade, leading to more intensive growth of few fields in relation to the others. Countries such as Germany, France and Netherlands have high competitive position on the international market, but also the low level of specialization. It is due to the fact that structures of their national economies. Taking into consideration the fact of innovativeness level of food industry, with exception of Netherlands, it is over average in EU (table 2). It confirms once more the thesis that innovative activity led by operators of food industry in these countries have a significant meaning as a factor of
competitiveness. Favorable situation was noted in Ireland, Luxembourg and Estonia. Relative the high importance of food industry in regional economy was accompanied by high level of innovative activity.

**Table 2.** Cluster specialization and innovative activity of food industry in EU countries

<table>
<thead>
<tr>
<th>Specification</th>
<th>Level of the cluster specialization</th>
<th>Level of innovative enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>high</td>
<td>Ireland Luxembourg Estonia</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>Malta Latvia</td>
</tr>
<tr>
<td></td>
<td>low</td>
<td>Austria Slovakia</td>
</tr>
<tr>
<td></td>
<td>verylow</td>
<td>Poland Romania Bulgaria Hungary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification</th>
<th>Level of the cluster specialization</th>
<th>Level of innovative enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>high</td>
<td>Greece</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>Belgium Denmark Germany Italy</td>
</tr>
<tr>
<td></td>
<td>low</td>
<td>Austria Slovakia</td>
</tr>
<tr>
<td></td>
<td>verylow</td>
<td>Poland Romania Bulgaria Hungary</td>
</tr>
</tbody>
</table>

**Source:** Own study based on figures 1-5

Significantly different situation was noted in Romania, Poland, Bulgaria and Hungary. Innovations as a factor and source of competitiveness in food industry has little meaning. Such approach does not favor gaining by these operators long lasting competitive advantage. The possibilities of competing of food industry enterprises from these countries which are a result of cluster potential limits their low level of innovativeness. It is convergent with the level of innovativeness of national economies of these countries – they are classified to the group of countries which have the lowest Synthetic Innovation Index (European Innovation Scoreboard 2016).

**Summary**

Conducted research revealed no dependencies between the relative strength of food industry clusters in EU countries and their innovative position. The taken hypothesis was not confirmed. This was the result of low level of innovativeness of few countries which have big or medium size, specialization and concentration of food industry clusters. Particularly unfavorable situation in this extent was noted in Romania, Poland, Bulgaria and Hungary. Low level of innovativeness of food producing operators in these countries was compatible with distant places within the innovation ranking of national economies. Different situation
was in Germany, France and Italy. Cluster potential of food industry was correlated with above average level of implemented innovations and high innovativeness of national economies. This indicates the importance of regional conditions of innovative activity of food manufacturing operators, connected with their general economic environment. In this context the connections between innovations of sectors and occurrence and relative strength linked with them clusters does not have direct character, should be considered.

References


