REGIONAL CLUSTER IDENTIFICATION IN FOOD MANUFACTURING INDUSTRY IN LATVIA

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Abstract
Regional clusters are widely used tool to promote growth of local businesses that leads towards the growth of the region and the nation. Regional clusters offer a platform for cooperation, collaboration and interaction between enterprises working in the same industry, supplementary industries, research, science and other institutions. Collaborative ties between cluster members ensure business growth in terms of efficiency, innovation capacity and competitiveness. The main issue with promoting regional clusters is the identification of region specific cluster industries developing in the specific industries naturally, that allows concentrating cluster support and establishing formal clusters in the industries with high cluster potential. Therefore, the aim of the research is to identify regional clusters and find industries with the highest cluster potential in regions of Latvia. The regional cluster identification methodology is applied to identify regional clusters in the food industry in Latvia. Cluster potential in the food industry in the regions of Latvia has not been researched before, although the food industry is fast growing industry in Latvia, ensuring both local demand and export growth. The regional cluster identification methodology is based on ranking four ratios- number, location quotient, specialization quotient and dominance, which are calculated for a number of enterprises, number of employees and turnover. Also authors identify clusters using Elisson and Glaeser and Maurel and Sedliot indexes. In each region, industries with the highest rank are identified as industries with the highest cluster potential. The results show that clusters in the food industry are resource dependent, emerging close to natural resources and ignoring formal borders of planning regions. Fish production and manufacturing cluster is identified in the coastal region, covering three formal regions- Riga, Pieriga and Kurzeme. Meat production and manufacturing cluster is identified in Zemgale and Latgale region, and milk production and manufacturing cluster is identified in Vidzeme region. The findings of the research show that clusters in the food industry are emerging in region specific industries, promoting local resources and establishing growth poles, therefore the need for cluster support to form formal clusters is indispensable in these regional clusters.

Keywords: regional clusters, regional specialization, regional development
Category: Research paper

1. INTRODUCTION

Cluster concept in scientific literature arises from research of Michael E. Porter (Porter, 1990, 1998a, 1998b, 1998c, 2000, 2003) and since then cluster development is widely researched and clusters are established to increase the competitiveness of enterprises, regions and nations (Garanti, Zvirbule- Berzina, 2013a, 2013b). Although the concept of geographic concentration of enterprises, cooperation and collaboration between enterprises and institutions have been discussed already by Marshall in early 20th century (2009), wider discussions arose almost a century later. Since then Italian school's creative milieu theory (Becattini, 1979, 1989, 1990, 2004; Bellandi, 2003; Lazzaretti, 2009) focuses on social and economical aspects of clusters; Californian school's transaction cost theory (Scott, 1988, 1994; Scott and Angel, 1987) focuses on cost reduction; new economic geography (Krugman, 1991a, 1991b, 1993; Schmutzler, 1999) looks at positive interactions between enterprises; regional innovation system theory (Cooke, 2001; Hae Soe, 2006; OECD, 1999, 2001, 2007a, 2007b, 2007c) emphasize high tech innovative cluster development. The recent trends in scientific literature show increasing interest in the regional dimension of clusters. Regional cluster theory grew from Perroux (1950) and his growth pole theory and nowadays it focuses on regional specialization, regional differences and regional development issues (Porter, 1990, 2000, 2003; Rocha, 2004; Rocha and Sternberg, 2005; Delgado *et.al.*, 2010,

2011; Regional Clusters in Europe, 2002). Research findings suggests that regional cluster can be defined as combination of five dimensions- single sector enterprises, that cooperate and compete; supportive enterprises from wide range of sectors; public and government institutions, interested in economic development of sector and region; other institutions, like research, education, finance and others and fifth is regional dimension, which combines all four previously mentioned dimensions into one region (Garanti, 2013a, 2013b; Garanti, Zvirbule- Berzina, 2013a, 2013b, 2013c, 2013d).

The present research is a first attempt to identify clusters in six planning regions of Latvia using cluster identification methodology developed by authors in a specific industry. Authors are applying cluster identification methodology in the food industry mainly because the food industry shows signs of natural clustering (enterprise being close to natural resources) and export growth (12% growth in 2013) which are important signs of cluster development. The main problem identified in Latvia by several authors (Garanti, Zvirbule- Berzina 2013c) is a gap between naturally emerging clusters and formal clusters established with EU and government support since 2009. Therefore authors suggest using cluster identification as a tool to determine where to concentrate support, so that clusters with high potential are supported and established. The **research aim** is to identify regional clusters in the food industry and three **research tasks** are set up:

1) To describe regional cluster identification methodology,
2) To apply regional cluster identification methodology in the food industry,
3) To analyse results of regional cluster identification.

The main methods used in the present research are monographic method as well as regional cluster identification methodology developed by the authors. The authors used data provided by Lursoft database (Lursoft data, 2014) that include a number of enterprises, turnover and number of employees for the year 2013.

2. REGIONAL CLUSTER IDENTIFICATION METHODOLOGY

There are two widely used methodologies to identify regional clusters (Garanti, Zvirbule-Berzina, 2013a, 2013b), the first being cluster mapping methodology and the second being cluster identification with indexes. First attempt to map clusters was carried out in Harvard Business School by leading professor M. E. Porter (2003) which was followed by cluster mapping in EU by leading professor O. Solvell (2003, 2008). Cluster mapping methodology is based on calculation of different indexes that shows localization and regional specialization, while indexes show the geographic concentration of economic activities. The authors apply both methodologies to identify regional clusters in Latvia. Data used for this research is obtained from Lursoft database. Methodology is applied for data obtained about enterprises showing NACE C10 industry (manufacture of food products) as their main industry.

Geographic concentration of economic activities is measured by **Ellison and Glaeser's agglomeration index (*EG*).** EG index was developed by Ellison and Glaeser in 1994 to measure geographic concentration of manufacturing industry in the USA (Ellison and Glaeser, 1994, 1997). EG index is applied to identify regional clusters in Sweden (Braunerhjelm and Borgman, 2006), New York (Gabe and Abel, 2010), Belgium (Bertinelli and Decrop, 2005), Belgium, Ireland and Portugal (Barrios *et.al.*, 2004), Turkey (Alkay and Hewings, 2012) and other countries. EG index is calculated according to formulae 1.

$$EG_p = \frac{G_p - (1 - \sum_j x_{j,p}^2) H_p}{(1 - \sum_j x_{j,p}^2)(1 - H_p)} \qquad \begin{matrix} j= 1,...,6 \\ p=1,...,9 \end{matrix} \qquad (1)$$

Where

G- coefficient of variance for locations of enterprises,
H- Herfindahl index,

x- total employment concentration,
p- food processing industries,
j- regions.

Interpretation of EG index is as follows:

- EG < 0- employment is distributed evenly and there is no evidence of geographic concentration;
- EG > 0- there is the evidence of the geographic concentration:
  - EG > 0.05- high concentration,
  - 0.02 < EG < 0.05- average concentration,
  - 0< EG < 0.02- low concentration.

Followed by EG index, Maurel and Sedliot (1999) suggest using **Maurel and Sedliot's index (*MS*)** that is a modification of EG index and is a slightly different index to measure geographic concentration of economic activities. The main difference between EG and MS indexes are the advantage of MS index due to it comes from a simpler probabilistic location model (Maurel and Sedillot, 1999; Alonso- Villar *et.al.*, 2004). MS index is used to measure the geographic concentration in the UK (The Geographic Concentration..., 2012), Australia (Leahy *et.al*., 2007), Spain (Alonso- Villar *et.al.*, 2004), New Zeland (Mare and Timmins, 2006) and other countries. MS index is calculated according to formulae 2.

$$MS_p = \frac{\frac{\sum_j s_i^2 - \sum_j x_{j,p}^2}{\left(1 - \sum_j x_{j,p}^2\right)} - H_p}{\left(1 - H_p\right)} \qquad \begin{matrix} j= 1,...,6 \\ p= 1,...,9 \end{matrix} \qquad (2)$$

where

H- Herfindahl index,
s- concentration of employment of an industry,
x- concentration of employment of an industry,
p- food processing industries,
j- region.

Interpretation of MS index is as follows:

- MS < 0- enterprises from the same industry tend to locate as far from each other as possible;
- MS = 0- there is not geographic concentration;
- MS > 0- there is geographic concentration. As higher is the index, as concentrated are enterprises.

Regional cluster mapping is done by applying both cluster methodologies- the methodology developed by M. E. Porter for the USA (Porter, 2003) and Solvell's methodology (Solvell *et.al*, 2003; Solvell, 2008) that was employed to identify clusters in the EU Member States. Both methods use only the number of occupied jobs, but as the researchers conclude (Porter, 2003; Solvell et.al., 2003; Solvell, 2008; Szanyi, 2012; Szanyi et.al., 2010) it is the main shortcoming of the method. Also methods map clusters in state level (USA) or NUTS 2 level (EU), that in some cases cover all countries (e.g. Latvia, Malta, Cyprus, Estonia). To resolve the two main shortcomings of the methodology, the authors use wider statistical data covering a number of enterprises, number of employees and turnover of the enterprises working in the NACE C10 industry in NUTS 3 level in Latvia obtained from Lursoft database.

The clusters were identified based on four cluster mapping indicators.

Number of employees/ number of enterprises/ turnover. The number of employees and enterprises is a significant indicator showing that a "critical mass" is achieved– a sufficient number of employees are employed and a sufficient number of enterprises are working in the particular industry concentrating high turnover, which leads to the emergence of a regional cluster. The

number of employees, enterprises and turnover in the food industries was ranked, assigning the highest rank to the regional cluster industries with the highest number of employees, enterprises and turnover.

Location Quotients (LQ). LQ is used to find out whether there is a concentration of some industry measured by the number of employees, enterprises and turnover in a region compared with other regions. This method compares the activity of a local industry relative to the overall activity in a country (Djira *et.al.*, 2008). This method was developed by Florence (1939) for analyzing the effects and economic basis of a regional economy. Location quotients reveal regional differences based on both the availability of natural resources (for instance, in coastal areas) and the comparative and competitive advantages, including the positive agglomeration effect of clusters of a local industry (Guimaraes *et.al.*, 2009). LQ is calculated according to Formula 3 that is developed based on the methodology of the Cluster Mapping Project (Cluster Mapping Project, 2003).

$$LQ_{j;p} = \frac{NOD_{j;p} / NOD_j}{NOD_{v;p} / NOD_v} \qquad \begin{matrix} j= 1,...,6 \\ p=1,...,9 \end{matrix} \qquad (3)$$

where

NOD- number of occupied jobs,
v- country,
j- region,
p- food processing industries.

For every region, industries are ranked based on LQ by giving the highest rank to the industries whose quotient is the highest, thus showing the location of this industry in the region.

Specialization Quotient (SQ). This method is based on an assumption that if a region, compared with other regions, has specialized in a certain cluster category, it is an indicator showing that the economic effects of a regional cluster are strong enough to attract related economic activities in this region from other regions and that cooperation links are stronger. This quotient is calculated according to Formula 4, which is developed based on the methodology of the European Cluster Mapping Project (Solvell, 2008).

$$SQ_{j;p} = \frac{NOD_{j;p} / NOD_p}{NOD_j / NOD_v} \qquad \begin{matrix} j= 1,...,6 \\ p=1,...,9 \end{matrix} \qquad (4)$$

where

NOD- number of occupied jobs,
v- country,
j- region,
p- food processing industries.

Dominance (D). If a cluster industry employs a greater proportion of the total number of employees employed in the region, it has more opportunities to form a strong regional cluster. The same applies for a greater proportion of enterprises and turnover. A dominance quotient (D) is calculated according to Formula 5, which is developed based on the methodology of the European Cluster Mapping Project (Solvell, 2008).

$$D_{j,p} = \frac{NOD_{j;p}}{NOD_j} \qquad \begin{matrix} j= 1,...,6 \\ p=1,...,9 \end{matrix} \qquad (5)$$

where

NOD- number of occupied jobs,
j- region,
p- food processing industries.

In the present research, every region's industry is ranked according to the value of quotients, giving the highest rank to the industries whose quotient is the highest, thus indicating the highest

proportion of this industry in the region.

3. REGIONAL CLUSTERS IN FOOD INDUSTRY

Regional cluster identification results based on calculation of indexes are shown in Table 1.

Table 1

Ellison and Glaeser's agglomeration index (EG) and Maurel and Sedliot's index (MS) values in food industry in Latvia in 2013

Industries	EG	MS
Processing and preserving of meat and production of meat products	0.21	0.21
Processing and preserving of fish, crustaceans and molluscs	0.03	0.03
Processing and preserving of fruit and vegetables	0.13	0.13
Manufacture of vegetable and animal oils and fats	-0.11	-0.11
Manufacture of dairy products	0.06	0.06
Manufacture of grain mill products, starches and starch products	0.15	0.15
Manufacture of bakery and farinaceous products	0.16	0.16
Manufacture of other food products	0.10	0.10
Manufacture of prepared animal feeds	0.04	0.04
Average	**0.09**	**0.09**

Source: Authors' calculations

EG and MS index values in the food industry first of all allows to conclude that there is not a significant difference between EG and MS index values (Table 1). Also authors that conducted previous researchers and applied both indexes came to the same conclusion (Kominers, 2008; Maurel and Sedliot, 1999). Secondly, the average value of the both indexes is 0.09 that shows that food industy in Latvia are somewhere concentrated. The highest EG and MS values are in the meat processing industry, showing high concentrations of this industry in some region compared with other regions, leading to the high potential of regional cluster. Also, high potential to form regional clusters is in other industries with high EG and MS values, e.g. grain mill product manufacturing, fruit and vegetable manufacturing etc. The only industry with negative EG and MS values is a manufacture of vegetable and animal oil and fats, showing that enterprises in this industry tend to localize as far as possible from each other. Calculation of EG and MS indexes shows the existing geographical concentration of economic activities, but it does not explain which region is more concentrated than others. Therefore, further cluster mapping in each region is necessary.

The regional cluster mapping methodology is applied to identify regional clusters in each statistical region in Latvia. Results of Riga region are summarized in Table 2.

Table 2

Cluster mapping results in food industry in Riga region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Processing and preserving of fish, crustaceans and molluscs; Manufacture of other food products; Manufacture of bakery and farinaceous products.	Manufacture of dairy products; Manufacture of grain mill products, starches and starch products; Processing and preserving of meat and production of meat products.	Manufacture of prepared animal feeds; Processing and preserving of fruit and vegetables; Manufacture of vegetable and animal oils and fats.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 1.16)	Average number of enterprises and dominance; average LQ and SQ (avg. 0.78)	Low number of enterprises and dominance; average LQ and SQ (avg. 0.84)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 1.44)	Average turnover and dominance; average LQ and SQ (avg. 0.75)	Low turnover and dominance; low LQ and SQ (avg. 0.40)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 1.21)	Average number of employees and dominance; average LQ and SQ (avg. 1.09)	Low number of employees and dominance; average LQ and SQ (avg. 0.53)

Source: Authors' calculations

Total 72 % of all enterprises are working in the three industries with the highest cluster potential, employing 62% of all employees in the region and generating 56% of the total turnover. As a result of the dominance of these three industries, average LQ and SQ coefficients are high (Table 2), while for the rest of the industries number, dominance, SQ and LQ are lower. Industry with the highest cluster potential in Riga region is processing and preserving of fish, crustaceans and molluscs, that has developed in the Riga region mainly due to access to the gulf and Baltic Sea and location of the main port of Latvia in Riga region. Because of the availability of the main resource for the processing, fish processing has developed around the port historically and nowadays it has high potential to form a regional cluster to force further development. Identification results for Pieriga region are summarized in Table 3.

Table 3

Cluster mapping results in food industry in Pieriga region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Processing and preserving of fish, crustaceans and molluscs; Manufacture of bakery and farinaceous products; Processing and preserving of fruit and vegetables.	Processing and preserving of meat and production of meat products; Manufacture of grain mill products, starches and starch products; Manufacture of prepared animal feeds.	Manufacture of other food products; Manufacture of dairy products; Manufacture of vegetable and animal oils and fats.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 1.09)	Average number of enterprises and dominance; average LQ and SQ (avg. 1.07)	Low number of enterprises and dominance; low LQ and SQ (avg. 0.73)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 1.48)	Average turnover and dominance; high LQ and SQ (avg. 1.43)	Low turnover and dominance; low LQ and SQ (avg. 0.90)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 1.37)	Average number of employees and dominance; high LQ and SQ (avg. 1.33)	Low number of employees and dominance; low LQ and SQ (avg. 0.85)

Source: Authors' calculations

Total 58% of all food processing industries of Pieriga region are working in the high cluster potential industries, employing 62% of all employees and generating 42% of the total turnover. As a result of the industry dominance, high cluster potential industries have higher LQ and SQ (Table 3), showing that Pieriga region is specialized in fish, bakery and farinaceous product and fruit and vegetable processing. Industries with average cluster potential are generating 37% of the total turnover, while industries with low cluster potential generate 22%. The industry with the highest cluster potential is processing and preserving of fish, crustaceans and molluscs, that has developed

in the Pieriga region mainly due to access to the gulf and Baltic Sea and location of the small ports in the region where the most active fishing takes place. Identification results for Kurzeme region are summarized in Table 4.

Table 4

Cluster mapping results in food industry in Kurzeme region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Processing and preserving of fish, crustaceans and molluscs; Processing and preserving of meat and production of meat products; Manufacture of bakery and farinaceous products.	Manufacture of dairy products; Processing and preserving of fruit and vegetables; Manufacture of other food products.	Manufacture of vegetable and animal oils and fats; Manufacture of grain mill products, starches and starch products; Manufacture of prepared animal feeds.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 1.28)	Average number of enterprises and dominance; average LQ and SQ (avg. 0.83)	Low number of enterprises and dominance; low LQ and SQ (avg. 0.59)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 1.70)	Average turnover and dominance; low LQ and SQ (avg. 0.33)	Low turnover and dominance; low LQ and SQ (avg. 0.15)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 1.22)	Average number of employees and dominance; low LQ and SQ (avg. 0.49)	Low number of employees and dominance; low LQ and SQ (avg. 0.20)

Source: Authors' calculations

In Kurzeme region industries with high cluster potential show high dominance as 78% of all enterprises are working in the three high cluster potential industries, employing 85% of all food industry employees in the region and generating 88% of the total food industry turnover in the region. High cluster potential industries show significantly higher LQ and SQ (Table 4), showing that regional specialization in Kurzeme is high, and as a result of the specialization only 20% of all enterprises work in the industries with average cluster potential, and 3% in the industries with low cluster potential. Industry with the highest cluster potential in Kurzeme region is processing and preserving of fish, crustaceans and molluscs, that has a deep historic roots in the region due to access to the Baltic Sea and the location of several ports in the region. Identification results for Vidzeme region are summarized in Table 5.

Table 5

Cluster mapping results in food industry in Vidzeme region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Manufacture of dairy products; Manufacture of bakery and farinaceous products; Processing and preserving of meat and production of meat products.	Processing and preserving of fruit and vegetables; Manufacture of prepared animal feeds; Manufacture of other food products.	Processing and preserving of fish, crustaceans and molluscs; Manufacture of grain mill products, starches and starch products; Manufacture of vegetable and animal oils and fats.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 1.56)	Average number of enterprises and dominance; high LQ and SQ (avg. 1.37)	Low number of enterprises and dominance; low LQ and SQ (avg. 0.37)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 1.50)	Average turnover and dominance; low LQ and SQ (avg. 0.38)	Low turnover and dominance; low LQ and SQ (avg. 0.02)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 1.71)	Average number of employees and dominance; average LQ and SQ (avg. 0.86)	Low number of employees and dominance; low LQ and SQ (avg. 0.07)

Source: Authors' calculations

In Vidzeme region industries with high cluster potential form 71% of all food industry, 88% of employees and 94% of the total turnover, leading to high LQ and SQ indexes (Table 5), showing high localization and specialization. These industries showed high cluster potential also with EG

and MS indexes (Table 1). 21% of all enterprises work in industries with average cluster potential, and 8% in the industries with low cluster potential, and these industries show lower LQ and SQ coefficients. Industry with the highest cluster potential in Vidzeme region is a manufacture of dairy products, as the region has a high concentration of dairy cows due to favourable natural resources. Identification results for Zemgale region are summarized in Table 6.

Table 6

Cluster mapping results in food industry in Zemgale region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Processing and preserving of meat and production of meat products; Manufacture of vegetable and animal oils and fats; Processing and preserving of fruit and vegetables.	Manufacture of bakery and farinaceous products; Manufacture of dairy products; Manufacture of other food products.	Manufacture of grain mill products, starches and starch products; Manufacture of prepared animal feeds; Processing and preserving of fish, crustaceans and molluscs.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 2.48)	Average number of enterprises and dominance; low LQ and SQ (avg. 0.89)	Low number of enterprises and dominance; average LQ and SQ (avg. 1.31)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 3.17)	Average turnover and dominance; low LQ and SQ (avg. 0.74)	Low turnover and dominance; low LQ and SQ (avg. 0.63)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 4.17)	Average number of employees and dominance; low LQ and SQ (avg. 0.63)	Low number of employees and dominance; average LQ and SQ (avg. 0.90)

Source: Authors' calculations

In Zemgale region high cluster potential industries employ 65% of the total number of employees in food industry, generate 54% of the total turnover. 40% of the total number of enterprises work in the high cluster potential industries, and LQ and SQ indexes are higher than other regions, showing deep specialization. Processing and preserving of meat and production of meat products industry was identified as high cluster potential industry according to EG and MS indexes (Table 1) and cluster mapping methodology identifies its high potential in Zemgale region. Meat production and processing industry has not only deep historic roots in the region, but also high potential to develop due to natural advantages. Identification results for Latgale region are summarized in Table 7.

Table 7

Cluster mapping results in food industry in Latgale region, 2013

Grouping	Industries with high cluster potential	Industries with average cluster potential	Industries with low cluster potential
Industries	Processing and preserving of meat and production of meat products; Manufacture of bakery and farinaceous products; Manufacture of dairy products.	Manufacture of prepared animal feeds; Manufacture of other food products; Processing and preserving of fish, crustaceans and molluscs.	Processing and preserving of fruit and vegetables; Manufacture of grain mill products, starches and starch products; Manufacture of vegetable and animal oils and fats.
Identification using number of enterprises	High number of enterprises and dominance; high LQ and SQ (avg. 1.24)	Average number of enterprises and dominance; high LQ and SQ (avg. 1.04)	Low number of enterprises and dominance; low LQ and SQ (avg. 0.49)
Identification using total turnover	High turnover and dominance; high LQ and SQ (avg. 1.55)	Average turnover and dominance; low LQ and SQ (avg. 0.65)	Low turnover and dominance; low LQ and SQ (avg. 0.01)
Identification using number of employees	High number of employees and dominance; high LQ and SQ (avg. 1.43)	Average number of employees and dominance; average LQ and SQ (avg. 0.97)	Low number of employees and dominance; low LQ and SQ (avg. 0.13)

Source: Authors' calculations

In the industries with the highest cluster potential 75% of the total enterprises, 88% of turnover and 85% of employees are concentrated, leading to high LQ and SQ coefficients (Table 7). The industry with the highest cluster potential is processing and preserving of meat and production of

meat products, that was identified as a high cluster potential industry also according to EG and MS indexes (Table 1), and shows high cluster potential in Zemgale and Latgale mainly due to suitable natural resources for meat production.

4. CONCLUSIONS AND RECOMMENDATIONS

In the present research, authors applied cluster identification methodology to identify regional clusters in the food industry. The results of the research shows emerging clusters in region specific industries based on each regions' advantages and available resources.

- Clusters in the food industry emerge according to availability of natural resources, ignoring formal borders of the regions. As a result of the cluster identification, fish production and processing cluster in the coastal region (covering three formal regions Riga, Pieriga, and Kurzeme) was identified. Fish processing tends to locate close to the coastline where the main resource for the processing is located.
- Milk production and processing cluster was identified in Vidzeme region. Vidzeme region shows high density of dairy farming that leads to high dominance, location of specialization of milk processing.
- Meat production and processing cluster was identified in Zemgale and Latgale region. Meat production has deep historic roots in these regions, as well as further potential to develop as the lands and nature is suitable for it. As a result meat processing is localized in these regions, showing highest cluster potential.
- When authors compare EG and MS indexes with the cluster mapping outcomes, the main conclusion is that all the industries with the highest cluster potential identified with mapping methodology have positive EG and MS indexes, indicating cluster potential. Both methods are suitable for cluster identification.
- Present research shows that strong regional clusters are emerging in the food industry, therefore in depth analysis is needed to determine potential of forming formal clusters in these industries.

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