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An analysis of conditions and the state of development of the agri-food clusters in Poland

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The work was carried out under the following theme:
Application of economic modelling in the analysis of the premises of competitive development of the agri-food sector
in the task: *Clusters' mapping in the agri-food sector for the purpose of modelling their development*

The purpose of this paper is to present the key determinants of the emergence and development of clusters in the Polish agri-food sector and to assess their relative economic strength in international terms.

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Introduction

Actions that may have the potential to foster the growth of competitiveness of economies have recently become an object of public interest practically around the whole world. The importance of the problem can be proved by the fact that the improvement of the competitiveness of the EU economy is one of the key priorities of the Europe 2020 Strategy[1]. The issue of competitiveness is also a part of the debate on the shape of the future of the Common Agricultural Policy. It is emphasized very clearly that a significant part of the instruments of this policy, especially that related to the second pillar, should focus on increasing the competitiveness and innovation in the agri-food sector.

In accordance with the recommendations of the European Commission, creating and developing clusters should be a very important way to strengthen the competitiveness of the economy[2]. This follows from the belief that it is not the enterprises but strong clusters that are the driving force of economies characterized by high competitiveness and high level of innovation. In scientific circles, as well as in those that represent different levels of economic policy, this view is promoted very actively by Professor M.E. Porter, a recognized world authority in the field of business strategy development and competitiveness. It is mainly in reference to his conceptual and methodological work that research on clusters is currently carried out in many different countries. The utilitarian goal of that research is to create an appropriate basis for formulating economic policy objectives that effectively stimulate growth. A specific example in this respect can be the cluster policy, whose objectives should be determined on the basis of research carried out in order to identify existing clusters, identify their potential for development or indicate the possibilities of creating new clusters in a given economic area.

This paper presents the results of an analysis of the key determinants and the state of development of the agri-food clusters in the Polish agri-food sector against the characteristics of such clusters in the EU and the USA. The analysis was conducted using primarily the methodological approach proposed by Porter. The analysis used the secondary data on the clusters from various, mostly international, sources. The study focuses on the methodological aspects of clusters' identification and studies, indicating the advantages and disadvantages of various options.

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[1] *A Strategy for smart, sustainable and inclusive growth*, COM (2010) 2020 final, 3 March, 2010, Brussels.

[2] *Towards world-class clusters in the European Union: Implementing the broad-based innovation strategy*, COM (2008) 652, 17 October, 2008, Brussels.

1. The economic substance of the cluster concept

Clusters are: *geographic concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations), in particular fields that compete but also cooperate* [Porter 1998a].

1.1. Origin and characteristics of the cluster concept

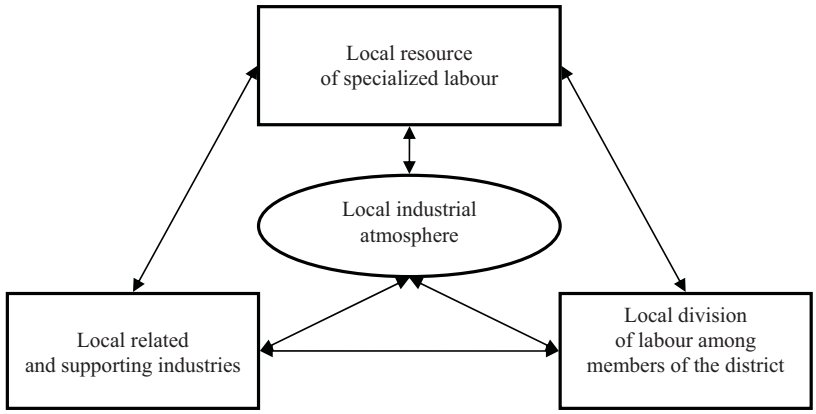
A feature of each national economy is the spatial diversity of management effects occurring within its borders. One of the trends in economic geography is to understand and explain the processes that determine the occurrence of spatial diversity and also determine the degree of its intensity. Over the last two decades, there has been a significant increase of interest in the phenomenon of spatial concentration of economic activity and its effects. Those studies are part of a trend in the so-called new economic geography (NEG).

Initially, the achievements in economics ignored the spatial dimension of the phenomena that take place in the economy and, consequently, economy was considered in such terms that it took a single-point character. It was only thanks to the work of economists who deal with land rent and international trade that location became a subject of study for a wider group of scientists. These particularly include, among others, Alfred Weber with his location theory (the theory of industrial location) and Johann Heinrich von Thünen (rings of agricultural activity). The canon of spatial economics also includes works by Alfred Marshall, who in his *Principles of Economics* (ed. I – 1890) laid the foundations of the theory of clusters.

Marshall analysed the situation of manufacturers in the textile (Manchester) and metal industry (Birmingham), and manufacturers of knives (Sheffield) [Gorynia and Jankowska 2007]. The result of his work was a statement that the geographical proximity of enterprises in a given industry, as well as of those from related industries, determined the occurrence of positive effects that benefit all entities within those industries. He formulated the concept of the industrial district, defined as a group of companies that specialise in different phases of the production process, which was associated with the acquisition, development and strengthening of skills and competencies, with a simultaneous occurrence of economies of scale [Gorynia and Jankowska 2008]. He argued that the economies of scale can affect a sufficiently large group of companies, which through their manufacturing operations are located in different phases of the production process

[Becattini 1991]. Marshall identified three types of externalities, the existence of which is associated with the operation of industrial districts (Figure 1.1).

Figure 1.1. Marshall's triad



Source: Skawińska and Zalewski 2009.

According to some researchers, Marshall presented not three but four types of externalities in his theory [Lindqvist 2009]:

- transfer of skills and inventions;
- development of related and support industries that supply the core of the district with specialized inputs and services;
- economies of scale in the case of shared use of specialized equipment;
- development of a local market for qualified staff.

Marshall's concept remained outside the mainstream research until its revival thanks to the works of the Italian economist G. Becattini, who referred to Marshall's industrial districts. Becattini's research focused on the phenomenon of "Terza Italia" (Third Italy), which was explained by, among others, the support given to small and medium-sized enterprises and the development of cooperation between them. Becattini defined the industrial district (*distretti industriali*) as a social environment that takes the form of a strong and dynamic organization where physical proximity and cultural ties allow for the use of the advantage of proximity in order to achieve the benefits of agglomeration, which gives small enterprises a chance to share certain costs and experience mutual positive reinforcement [Figuła 2008].

The phenomenon of agglomeration is associated with the occurrence of different types of accompanying effects (economies of agglomeration). Economies of agglomeration are included in the group of external economies of scale. They are related to the benefits for companies or urban centres, which occur due

to the spatial proximity [Healey and Ilbery 1990]. Economies of agglomeration may be related to a close – in terms of location – operation of companies with the same business profile (location economies) or all entities (urbanization economies) [Hoover 1936]. The first group of economies refers to the concentration that occurs between firms that take up identical, technologically similar, or complementary activities, which results in the emergence of structures of industrial districts in an urban or regional environment. In the case of the urbanization economies, which are a consequence of operating within a structure characterized by spatial concentration, regardless of the business profile, metropolitan regions or industrial regions come into being [Ketels et al. 2008].

The benefits brought about by agglomeration were studied by Swedish economist B. Ohlin. He identified their sources as the following [Skawińska and Zalewski 2009]:

- internal economies of scale that are associated with production techniques;
- the benefits of location, as a manifestation of the impact of the industry on a single entity;
- the benefits of urbanization, which are a manifestation of the functioning of the economy as a whole and have an external nature with respect to companies and industries;
- links between the industries.

The distinction of four types of agglomerations, namely cities, industrial districts, creative regions and clusters, as shown in Table 1.1, is based on the delimitation carried out along two dimensions. The first one concerns the degree of technological connection between operations (diversification of operations within the analyzed agglomeration, in comparison with agglomeration of operations linked in terms of technology). The second dimension relates to the separation of agglomerations characterized by economies in terms of performance (largely the economies of scale) and agglomerations with innovative benefits [Sölvell 2009].

The first type of agglomeration – a city – is associated with the occurrence of benefits available to all companies and industries that stem, *inter alia,* from lower transport costs. Under favourable circumstances, urbanization economies can lead to the development of metropolitan areas or functional regions, characterized by an increased intensity of industrial activity[3]. Industrial districts, which are the second type of agglomerations that experience urbanization economies, include companies concentrated around a similar profile of activity or related activities. Those agglomerations are characterized by flexible productive systems. In both cases, there is an improved performance and operational flexibility [Sölvell 2009].

[3] An example of the region with an industrial profile is the American Rust Belt.

Table 1.1. Four Types of agglomerations

Effects of operations	Characteristics of business	
	Diversification of activities	Activities linked in terms of technology
Performance and flexibility	**CITIES**	**INDUSTRIAL DISTRICTS**
Innovations	**CREATIVE REGIONS**	**CLUSTERS**

Source: Malmberg et al. 1996.

Creative regions and clusters are examples of agglomerations with knowledge creation and innovative processes. In the case of clusters, a very important role in their functioning is played by processes related to the exchange of information and the flow of know-how. Also creative regions are an example of agglomerations where those processes play a key role. In their case, however, there is no limitation only to the analysis of technologically related activities, because the emphasis is on analysis in general, not in selective terms [Sölvell 2009].

Attempts to define what a cluster is have been and are still made by many authors. Due to its interdisciplinary nature, the theory of clusters as a specific form of agglomeration is gaining importance due to the interest on the part of scientists from different fields. For this reason, one can find in the literature a number of terms that are identical or similar to the concept of the cluster. Their summary is shown in Table 1.2.

Table 1.2. Concepts related to clusters

Authorship	Concept
Perroux (1988)	Growth Pole
OECD (1996)	Network
Drejer, Kristensen, Laursen (1997)	Industrial Complex
Fridh (2000)	Competence Blocks
Whalley, den Hertog (2000)	Regional Cluster
Dahmen (1988)	Development Blocks

Source: Own elaboration based on Brodzicki and Szultka 2002.

Apart from M.E. Porter's – who is one of the most cited authors in this field – definition of the cluster quoted at the beginning of the chapter, there are many other definitions in the literature, similar to a greater or lesser extent to his proposal. Some of them are shown in Table 1.3.

Clusters can be properly identified in space when their attributes are defined. Ketels [2004] included the following of them:

- geographical proximity (the distance between entities that belong to the cluster must allow for positive spillover effects);
- connections (focus on a common goal);
- interactions (that occur between entities);
- number (interactions between players located in geographical proximity must affect such a number of players that guarantees the achievement of the so-called critical mass).

Identification of cluster structures consists in separating from a series of market relations those relationships that relate to the functioning of the value chain in the vertical and horizontal dimension. Established relationships connect entities that represent different links in the chain. Therefore, the following groups of entities can operate within clusters [Sölvell 2009]:

- companies (competitors, suppliers, service providers, buyers and companies in related sectors);
- representatives of the public sector (central and regional level and local communities);
- representatives of the academic community (universities, research institutes, technology parks, technology transfer centres, etc.);
- organizations that promote cooperation (chambers of commerce, cluster organizations, etc.);
- financial institutions (finance facilities);
- media (creators of the brand of the cluster and the region).

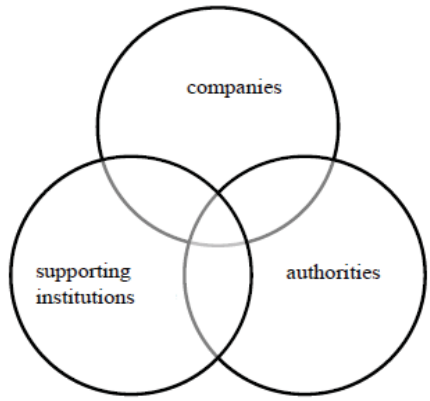
The concept of clusters as proposed by Porter does not include companies only. A very important element of theoretical considerations on the role and importance of clusters in the economy is the expansion of the theoretical model to include the relationships that arise between companies, R&D and supporting institutions (business environment institutions). In addition, a cluster is not a system that brings together only one type of activity or representatives of one industry. Great emphasis is placed on the relationships that connect the so-called core of the cluster with companies that represent related, complementary or supporting activities. The diversified character of the entities involved in the cluster can be illustrated using a Venn diagram, where the overlapping area of all three elements reflects the structure of the cluster (Figure 1.2).

Table 1.3. Summary of selected definitions of clusters

Authors [year]	Definition
Anderson [1994]	A group of companies which actively builds its business on relationships that arise between them, established in order to achieve efficiency and competitiveness.
Rosenfeld [1997]	A geographic concentration of companies in related industries that operate in the local market, which cooperate, or are connected in another dimension, provide complementary services, and use common infrastructure and specialized suppliers.
Cooke [2002]	A geographic concentration of companies, between which there are links of a horizontal and vertical nature, which at the same time cooperate and compete with each other within specific market segments, using common local infrastructure and sharing the same vision for the development of the region and the industry in which they operate.
The World Bank [2002]	Production networks composed of independent companies and their specialized retailers, centres of knowledge (e.g. universities, research and development institutes), supporting organizations (consultants, intermediaries) and their clients [Bojar 2007].
Gorynia, Jankowska [2008]	A group of companies and other entities (associations, chambers of commerce and industry, research institutions, etc.) which operate in geographic proximity and are characterized by above-average intensity of different relations, and those relations largely go beyond typical market relationships (confrontational, competitive).

Source: Own elaboration based on the work of the cited authors.

Figure 1.2. Triple helix



Source: Own elaboration.

Determining whether a cluster is present in a given space is not always indisputable. The difficulty lies in the fact that in the literature there are many definitions and interpretations which are not very clear. Van Dijk and Sverrisson, on the basis of the study of literature, formulate a list of clusters' features that can be observed directly. These are [van Dijk and Sverrisson 2003]:

- the relative proximity of enterprises;
- the high density of economic activity;
- the presence of a number of companies engaged in the same, similar or complementary type of activity.

In addition to the features of clusters that are fundamental and universal in nature, they also include:

- linkages between companies that result from subcontracting and vertical dependence;
- linkages between companies which take specific forms of cooperation (horizontal dependence);
- a certain degree of specialisation.

Clusters are present in virtually all types of business structures, from towns and cities, through regions, countries, but they also operate across the borders of these divisions. The cluster theory puts special emphasis on the importance of location in business activity. Competitive advantage is not developed only within a company, but also depends on the degree to which an enterprise takes advantage of the opportunities provided by the environment.

Human activities have always been characterized by concentrated spatial distribution, to some extent related to the presence of obstacles in the natural environment. This concentration in many cases resulted, through the specialization that occurred within its limits, in increased innovation and competitiveness. According to Porter, one of the reasons for the market success of cluster structures is the networking between related and complementary industries and the group of entities that affect the competitive climate of the location [Porter 1998b]. Thus, cluster boundaries are defined through the span of those connections.

According to Gordon and McCann, spatial clusters of companies, along with related phenomena and effects, can take three basic forms, which are: classic agglomeration, industrial complex and the network [Gordon and McCann 2000]. Each has a different set of properties that are listed in Table 1.4.

Table 1.4. Three forms of business clusters

Feature	PURE AGGLOMERATION ECONOMIES MODEL	INDUSTRIAL COMPLEX MODEL	SOCIAL NETWORK MODEL
Size of companies	Small enterprises, without any market power	Some large enterprises	Different enterprises
Nature of relationship	Not visible, cannot be identified	Visible, can be identified	Based on trust
Membership	Open	Closed	Partly open
Access	Location at a specific place required	Investments at the level of companies, location at a specific place required	History and experience
Spatial character	Urban environment	Local environment, but outside urban areas	Local environment, but outside urban areas
Analytical approach	Pure agglomeration economies model [Marshall 1932], [Krugman 1991], [Fujita et al. 1999]	Theory of input-output [Weber 1909], [Moses 1958], [Isard, Kuenne 1953]	Network theory [Granovetter 1973]

Source: Gordon and McCann 2000.

The cluster, as an example of an economic mesosystem, is subject to transformation processes. In this regard, Enright [1999] lists [Gorynia and Jankowska 2008]:

- operating clusters, in which the members, by virtue of conscious activity in the cluster, are able to fully exploit its potential;
- latent clusters, where the entities that constitute them do not gain benefits yet;
- potential clusters, possible to be developed in space, but only if certain conditions are met.

According to another view on the process of development of cluster structures, we can identify three stages within it [Wojnicka 2002]:

- the stage of learning, which consists in learning to cooperate between large and small companies;
- the stage of maturity, which includes the development of cooperative activities with an increase in production;
- the stage of globalization.

Throughout the life cycle of clusters their structure and size undergo many changes. Their analysis allows us to outline several stages of development which depend on the specific circumstances. The life-cycle phases include [Skawińska and Zalewski 2009]:

– the embryonic phase,
– the growth phase,
– the maturity phase,
– the decline phase.

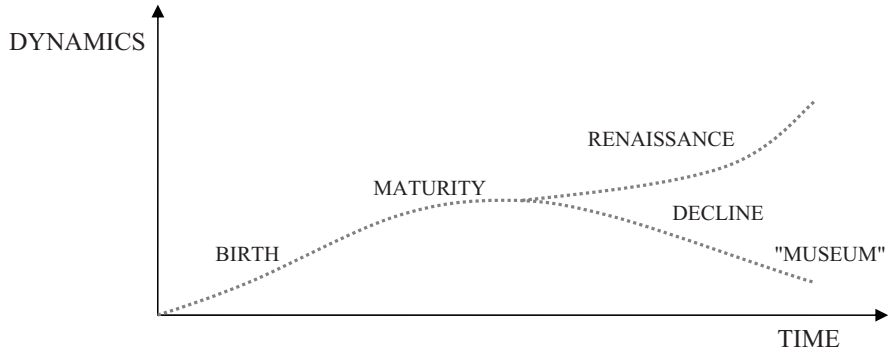
Sölvell presents the life cycle of clusters in a similar manner. His analysis introduces an additional stage, the renaissance, which can potentially become a part of the life cycle of a cluster [Sölvell 2009]. Changes in the cluster over time are illustrated in Figure 1.3. The emergence of the cluster (its birth), according to Sölvell, may occur in either of two ways. The first involves the presence in a given location of specified advantages with respect to the set of resources available. The other concerns a situation in which the initiation of the formation of a cluster should be assigned to historical circumstances and the merits of a particular business person who started the process of concentration within a particular industry (referred to as the hero).

In the next stage, the intensity of competition and cooperation increases [Sölvell 2009]. The environment plays an important role in this process. Porter's diamond model illustrates the conditions whose occurrence and interactions affect the development of clusters[4]. Its vertices, i.e. the demand conditions, factor conditions, the context for business strategy and rivalry, and related and supporting industries, if they create a well-functioning system, determine – as location factors – the role and power of clusters in space.

The length and course of the life cycle of clusters depend on many factors (Figure 1.3). Some clusters enter the stage of maturity relatively quickly, while for others, the stage of the greatest productivity, during which the economies of scale are used, can even last centuries. Over time, the processes that take place in cluster structures may lead to their decline. On the one hand, the final result of such a process can be referred to as a "museum". On the other, also a rebirth (renaissance) of the cluster may occur, for example through the entry of new companies, or the introduction of technological or institutional changes [Sölvell 2009].

[4] More information about Porter's diamond model – see [Porter 1998c].

Figure 1.3. The life cycle of a cluster



Source: Sölvell 2009.

Cluster structures can take many forms. In one of the most widely cited typologies of clusters, they are divided into:

- network clusters (which correspond to Marshall's industrial districts);
- concentric clusters (hub-and-spoke);
- satellite clusters;
- institutional clusters (anchored around institutions).

This classification is based on the work by Markusen [1996], in which the author indicates attributes of the so-called new industrial districts. They differ, *inter alia*, in the characteristics of companies that operate within them and in the interdependence between their elements. Table 1.5 presents a summary of their selected attributes.

In a knowledge-based economy, enterprise networks have become a regular feature of the business landscape. The importance of relations between economic actors increases, as proper management can lead to increased efficiency and effectiveness of activities, thus enhancing competitiveness. In theory and practice, special emphasis is placed on the flexibility of relationships that arise between the representatives of the different levels of the supply chain.

Networks, whose goal is to establish cooperation, may be defined in many ways. The common denominator of most definitions of enterprise networks is to emphasize the importance of cooperative relations, which are usually informal [Skawińska and Zalewski 2009].

Jewtuchowicz [2001] sees the network as a set of relations with selected partners that are part of market relations between enterprises. These relations include relationships of cooperative and competitive nature. Thus it seems necessary to outline a theoretical boundary between the concepts of network and cluster. An analysis of the features that differentiate the two concepts was con-

ducted, *inter alia,* by Rosenfeld [1997]. The list of the differences established by him is shown in Table 1.6. This Table should be expanded to include at least one other dimension, which refers to the condition of the spatial concentration of economic activity. In the case of network structures, that condition does not need to be met, while the fundamental characteristic of a cluster is the geographical proximity between the entities that form it.

Table 1.5. Attributes of districts according to Markusen

Form of district	Attributes
Marshall's district	– dominance of small and medium-sized enterprises owned by local entrepreneurs; – some economies of scale; – long-term contracts concluded between local buyers and suppliers; – weak links and cooperation with companies functioning outside the district; – flexible labour market; – evolution of a unique local cultural identity.
Italian districts	– as above, plus: – important role of local authorities in regulating and promoting key industries; – high degree of cooperation between competitors to share risk, stabilize the market and share innovation.
Concentric districts (hub-and-spoke)	– business structure dominated by one or a few large horizontally integrated companies; – significant economies of scale; – extensive links with companies outside the district (suppliers and competitors); – a less flexible labour market.
Satellite districts	– business structure dominated by large enterprises with headquarters outside the district; – lack of long-term cooperation with local suppliers.
Districts anchored around institutions	– business structure dominated by one or several large institutions, mostly government (e.g. large universities, military bases).

Source: Own elaboration based on Markusen 1996.

Table 1.6. Differences between networks and clusters

A network	A cluster
allows companies to access specialized services at lower cost	attracts specialized service providers to the region
characterized by restrictions on membership	membership open to every entity
the basis for the existence are contracts and agreements	based on social values, trust and reciprocity
facilitates engaging in economic activity for a greater number of companies	generates demand for the presence of a larger number of enterprises with similar and related skills
based on cooperation	based on cooperation and competition
there are common business goals	cluster participants have a common vision

Source: Rosenfeld 1997.

Development of clusters in economic space is associated with the presence of competition and cooperation processes. From the point of view of economic entities, as well as the economy of a given region, clusters affect the economic balance, both in terms of the benefits they bring, as well as costs. Martin and Sunley [2003] compiled a list of the advantages and disadvantages of clusters, which is presented in Table 1.7.

Table 1.7. Advantages and disadvantages of operating within clusters

Advantages	Disadvantages
1. Greater innovation	1. Technological isomorphism
2. Higher growth rate	2. Increase in labour costs
3. Higher productivity	3. Increase in the cost of land and buildings
4. Increased profitability	4. Increase in revenue diversification
5. Increased competitiveness	5. Excessively narrow specialization
6. Increase in the number of new enterprises	6. Pressure from the environment
7. Increase in the number of jobs	

Source: Own elaboration based on Martin and Sunley 2003.

Enright [1999] listed a number of dimensions, on the basis of which one can identify clusters. The list should be used to standardize various classifications and to allow comparisons at the stage of identification and analysis of clusters and their potential. A list is shown in Table 1.8[5].

Due to the diversity of relationships that occur in clusters in various countries around the world, a few examples of typical cluster structures in certain locations can be highlighted. Italian, Dutch and Danish clusters are particularly noteworthy. The characteristics of Italian business clusters include their lack of formal structure, considerable importance of family businesses that determine the manner of establishing cooperation between companies, the importance of tradition in business, and a lack of coordination structures. In the case of Dutch structures, special attention should be paid to the fact that entities that fulfil an important role in these clusters include research centres, which by cooperation with network brokers establish contacts with companies that make up the cluster. Danish clusters in turn are characterized by an active role of institutions which facilitate establishing and upholding the contacts between companies (so-called network brokers) [Gorynia and Jankowska 2008].

The emergence and development of clusters depend on many factors. These conditions can be distinguished within a framework of four groups [Mikołajczyk et al. 2009]:

- historical (in most cases associated with a strong tradition in the industry);
- geographic (location in space, natural factors, resources);
- economic (demand conditions, knowledge, experience and skills, the degree of development of financial markets, expanded research and development activity);
- political (activities aimed at promoting regional specialization).

[5] "Width" means the degree to which there is a link between sectors in a horizontal dimension, while "depth" means the number of stages of the production chain included in the cluster [Gorynia and Jankowska 2008].

Table 1.8. Dimensions of clusters according to Enright

Dimension	Type	Example
Geographical coverage	- concentrated - dispersed	- Sassuolo – ceramic tiles - Japan – synthetic fabrics
Density	- dense - scattered	- New York – financial - New Hampshire – medical tools
Width	- wide - narrow	- Osaka – electronics - Dalton – carpets
Depth	- deep - shallow	- Denmark – agricultural cluster - Ireland – pharmaceutical cluster
Activity (technological advancement)	- high - low	- the Silicon Valley - Chihuahua – *maquila* activity
Growth potential (competitive position)	- growing (competitive) - growing (non-competitive) - stabilization (competitive) - stabilization (non-competitive) - shrinking (competitive) - shrinking (non-competitive)	- Los Angeles – multimedia cluster - Quebec – transport equipment cluster - Boston – cluster of mini-computers
Innovative capacity	- high - low	- Boston – biotechnology cluster - Singapore – electronics
Industrial organization	- core-ring structure with coordinating company - core-ring structure with leader company - structure without a coordinator or leader (all ring-no core and all core-no ring)	- Veneto – clothing cluster, Toulouse – aviation cluster - Capri – cluster of knitting companies
Coordinating mechanisms	- spot markets - short-term coalitions - long-term relationships - hierarchy	- Prato – textiles - Hollywood – film industry - Turin – automatics - Detroit – automotive

Source: Enright 1999.

1.2. Competition and cooperation within cluster structures

Competition is an integral element in the functioning of enterprises. Attempts at describing its nature are reflected in a series of definitions that represent different approaches to the concept. Marshall saw competition as rivalry based on competing and bidding when buying and selling. Tkaczyk defines competition as a process in which market participants, in the pursuit of their interests, try to make offers that are better than those of their competitors (the benefit can refer to different types of characteristics, such as price, quality, terms of service, etc.) [Przybyciński 2005].

The issues of competition can be found in the works of representatives of a number of schools and trends in economics. Authors of classical economics promoted the view in which competition was considered an essential element in optimizing the use and distribution of resources and, consequently, in maximizing social welfare. Competition that takes place in the open market required refraining from intervention in the economy by state authorities. In neo-classical terms, competition was characterized as a certain condition that occurs in the market. Thus, the static approach developed under that trend refers to a situation in which there is a high degree of atomisation on the supply side of the market, which gives rise to a structure which is the opposite of the monopoly [Gorynia and Łaźniewska 2009].

Rivalry (competition) is also a component of game theory, which searches for the most optimal effects of a conflict of interest. Game theory, which is used by economists, among others, describes various forms of games that can be used to map the behaviour of market players. Among them we can distinguish zero--sum game (the win of one player means the loss of another), non-zero sum games (players achieve profits or losses, and the optimum for each player is above the optimum of the whole system) and games with a dominant strategy (the best strategy of a single player is not dependent on the strategy of another player) [Gorynia and Łaźniewska 2009].

Competing is a process whose implementation and progress determine the achievement of competitiveness understood as a state, attribute, but also as a process. The issue of competitiveness has recently become a major area of research in economics. Its importance stems largely from the relationship, perceived and emphasised in many studies, with the economic development of countries or other geographically separate areas, translated into an increase in overall economic welfare.

Competitiveness is a derivative of the concept of competition. Competition is in fact a precondition for the discussion on competitiveness to take place at all [Gorynia and Łaźniewska 2009]. Finally, the issue of competition is wide-

ly analysed and commented on due to the confrontation and rivalry among the actors in economic life. The forms of competition and attitudes towards it have changed along with the transforming perception of the market.

The discussion on competitiveness can take place on many levels. The most commonly used criterion for delimiting competitiveness is the criterion of the hierarchy of economic systems. According to it, generally speaking, competition can be considered at the following levels:

- macroeconomic (national economies, regions of the world),
- mesoeconomic (industries, branches, sectors, etc.),
- microeconomic (enterprises, institutions, etc.).

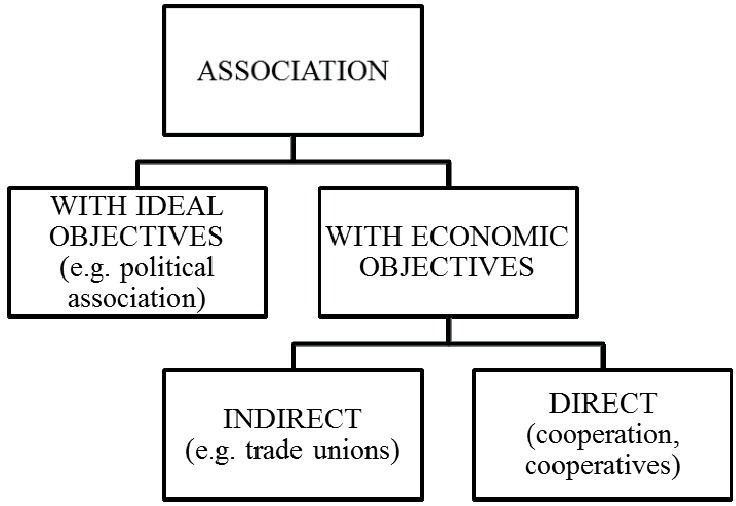
As a component of economies, clusters affect the prevailing climate of competition [Kuberska 2008]. They influence competition and competitiveness in several dimensions. Firstly, enterprises that operate in cluster structures are able to increase their productivity. Secondly, an attractive business environment and the prospect of development for the industry promote the formation of new enterprises and supporting institutions. In addition, a number of analytical studies also prove that there is a relationship between the greater level of innovation in companies and industries and the greater spatial concentration of enterprises [Porter 1998b].

Competition is considered to be the driving force of economic activity. But the ties that are established between economic actors do not only take the form of competition. Competition is just one example of the relationships that arise between them. Another type of relationship, singled out from among the dependencies on the market, is cooperation.

The benefits of working together have been experienced throughout the history of mankind. Cooperation is entered into for a variety of reasons and can take different forms depending on the context to which it relates. Romanow [1999] saw cooperation (cooperativeness) as a special form of association for directly economic purposes. Figure 1.4 shows the types of associative institutions.

In recent years, more and more attention in the economic literature is devoted to the importance of cooperation between economic actors. The interest in this regard relates to its sources, causes, course and results achieved through it. The concept of clusters is one of the manifestations of that interest, because cooperation is one of the elements that characterize those market structures. In the case of clusters, cooperation does not only occur between the representatives of different groups of actors (companies – R&D – authorities); its fundamental importance is also emphasised within the framework of value creation.

Figure 1.4. Classification of associative institutions



Source: Own elaboration based on Romanow 1999.

The occurrence of competition and cooperation is a determinant for another relationship to arise between market participants, namely co-opetition[6]. The term is derived from two English words: competition and cooperation. There is no clear position as to who the author of the concept is. Some authors, such as Dowling et al. [1996], Bagshaw and Bagshaw [2001] and Dagnino and Padula [2002] attribute the authorship to Raymond Noorda, founder and CEO of Novell Corporation [Walley 2007].

Co-opetition is considered to be one of the types of relations between market players in horizontal terms. Enterprises, acting in accordance with an established strategy, engage in relationships with other entities, the nature of which can be varied. It is acceptable to uphold all the types of relationships as shown in Table 1.9 at the same time.

Coopetition, which is a juxtaposition of the two elements considered mutually exclusive up to a certain point, can be defined as a situation in which competitors cooperate and compete with each other at the same time [Bengtsson and Kock, 2000]. According to many authors, coopetition relations which the company can successfully establish should be considered on the basis of the so-called value net (Figure 1.5[7]).

[6] Alternatively, the concept of coopertition is used.
[7] Complementators are companies that offer goods on the market that complement the offer of other producers.

Coopetition actions that take place between the parties are not identical, each of them has its own individual characteristics. Their classification according to the criteria of weights assigned to competition and cooperation, proposed by Bengtsson and Kock, allows for identifying [Bengtsson and Kock 2000]:

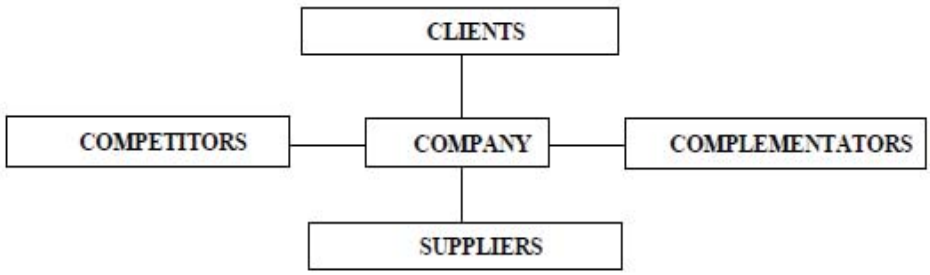
- relationships dominated by cooperation – with greater emphasis on cooperation;
- balanced relationships – the same proportion of cooperation and competition;
- relationships dominated by competition – competition dominates over cooperation.

Table 1.9. Horizontal market relations

Type of relation	Properties
Coexistence	- lack of economic relations - lack of interactions
Competition	- activity based on action-reaction - observation and following the competitors
Cooperation	- relationships between competitors may concern business and social areas or exchange of information - all kinds of relationships are established
Coopetition	- exchange in economic and non-economic terms - clear guidelines of coopetition exist, often based on formal arrangements

Source: Own elaboration based on Bengtsson and Kock 1999.

Figure 1.5. Value net



Source: Own elaboration based on Nalebuff and Brandenburger 1997.

Branderburger and Nalebuff, in their work that belongs to the canon of literature in the field of coopetition[8], recognized it as a non-zero-sum game. It should be noted that coopetition does not consist in eliminating other entities or restricting their access to the game, as is the case with competition and its purpose is for the entities that engage in it to obtain greater benefits [Jankowska 2009]. Skawińska and Zalewski [2009] distinguished six dimensions that differentiate the relationships between actors in the market, which take the form of competition, cooperation and coopetition [Skawińska and Zalewski 2009]. These are shown in Table 1.10.

The existence of coopetition should not benefit just companies but also other market participants, in particular customers [Walley 2007]. Despite the gains that can be derived from the simultaneous cooperation and competition, there are a number of reasons for terminating coopetition between the parties. These include inadequate benefits for one of the parties, leakage of confidential information, lack of confidence or a tendency to recognize competition as a superior type of activity [Walley 2007]. For coopetition to prove an effective strategic position, one should set common goals for those that use it. It can be assumed that above all the convergence of goals should pertain to the long-term horizon [Jankowska 2009].

Table 1.10. Types of relationships between competitors

Feature	Type of relationship		
	Competition	Cooperation	Coopetition
Frequency	high	high	high
Strength of links	weak	significant	significant
Form of relationships	informal	formal/ informal	formal/ informal
Level of confidence	low	high	average
Resources owned	sufficient	insufficient	insufficient
Market position	strong	weak	strong

Source: Own elaboration based on Skawińska and Zalewski 2009.

[8] More on coopetition see: Nalebuff B.J., Brandenburger A.M., 1996: *Co-opetition*. Harper Collins, London.

The phenomenon of coopetition applies in particular to structures that operate in economic mesosystems, such as clusters, industries, sectors. According to Jankowska [2009], coopetition, as a special case of behaviour adjustment, should have the effect of introducing order in the economic processes that take place within their boundaries.

The idea of clusters connects activities that are competitive and cooperative in nature. The reality of the market entails that without intense competition clusters do not have development opportunities. Cooperation that occurs within the cluster focuses mainly on vertical relationships. It takes place between enterprises that constitute the core of the cluster and represent its main activity, and local institutions and companies that operate in related sectors. Thus, competition and cooperation are not mutually exclusive, as they mainly occur between different players and in different dimensions [Porter 1998b].

1.3. Clusters and cluster initiatives

In recent years the issue of clusters has been an object of the interest for economic policy makers. This is reflected in strengthening the competitiveness of economies through the formulation and implementation of measures for the development of clusters in policies related to the functioning of regions, industries or companies. One of the most noticeable signs of interest in clusters is the establishment of cluster initiatives. "Cluster initiatives" refer to organized actions aimed at promoting the development and strengthening the competitiveness of clusters, which include companies that belong to a cluster in the region, entities that represent the government and/or representatives of research institutions [Sölvell et al. 2003]. The varied composition of cluster initiatives as presented in the definition above corresponds to the classical definition of the cluster by Porter, which also identified multifaceted components. According to Skawińska and Zalewski [2009], a cluster initiative is "the collective activity of groups of enterprises, public sector entities and other related institutions in order to improve the competitiveness of economic actors in the region".

Supporting cluster initiatives has become one of the leading elements of economic policy, guided by development, innovation and competitiveness. Established cluster initiatives can take different forms in different locations, depending on the regional circumstances. In practice, several types of structures can be distinguished, by means of which actions for phenomena corresponding or similar to clusters are institutionalized. Cluster initiatives are one of them. In other cases, the historically conditioned naming of this kind of organization is often used. This is particularly true in those areas where the socio-cultural factors have a strong influence on the functioning of the corporate sector. Italian industrial districts (*dis-*

tretti industriali) may serve as an example of a unique global approach in this respect [Becattini 1991].

The formation of cluster initiatives is independent of the degree of economic development. Both in developed economies and in economies with a lower level of economic development, there is a noticeable growth trend in the presence of the cluster issues and accompanying initiatives in the economic practice. In addition, cluster initiatives may operate regardless of the industry profile of the cluster they support.

The objectives of cluster initiatives may relate to different dimensions of the functioning of enterprises and the region they pertain to. The most common include:

- cluster development, achieved through efforts to increase the level of investment attractiveness of the area, and as a result – to the formation of new enterprises in the region, whose activity corresponds to the profile of the cluster, or to encourage already existing enterprises to start their operations in the region;
- support for innovative activities;
- bringing out and supporting cooperative activities;
- support for staff development processes.

Cluster initiatives and the accompanying policies, regardless of the location that determines their unique features, can be described by a set of universal attributes. These include [Sölvell et al. 2003]:

- increased focus on the microeconomic business environment in place of traditional approaches focused on macroeconomic issues;
- a long-term programme aimed at improving the competitiveness of clusters rather than individual companies or sectors;
- emphasis on local and regional areas;
- improvement of contacts between companies in the cluster, building confidence and improving dialogue that will contribute to the creation of externalities;
- provision of seed capital in place of large grants;
- balanced contribution from the government and the industry;
- selection of clusters using the criterion of competition, which implies a milder form of selecting the winner;
- combination of competition and cooperation as essential factors for learning and innovation;
- participation of SMEs and large enterprises;
- partnership within the triple helix, including not only companies from the cluster and the authorities, but also the academic community;

– learning and innovation based on the whole system rather than on the example of individual companies.

Establishing cluster initiatives may but does not have to accompany the independent processes of competition and cooperation within the framework of existing clusters. Depending on the degree of development of clusters, we can distinguish three alternative scenarios for the relationship between the occurrence of clusters and taking up cluster initiatives (Table 1.11).

Table 1.11. Alternative scenarios for the occurrence of clusters and cluster initiatives

SCENARIO	CLUSTER	CLUSTER INITIATIVE	CONTEXT
1.	+	-	Processes of competition and cooperation are present, but no organization is established to support the cluster.
2.	-	+	The cluster initiative is formed at a time when spatial specialization processes are not in place or are at initial stages.
3.	+	+	Temporal and spatial convergence in the functioning of the cluster and the supporting cluster initiative.

Source: Own elaboration.

The variety of the alternatives presented is associated with a variety of purposes for which initiatives are established. Some of them are created to support the efforts of local, regional or central authorities to start or strengthen the already initiated processes for the emergence of clusters of companies with the same profile of activity (scenario 2). In other cases, agreements on cluster initiatives aimed to support the existing cluster structures are established (scenario 3). It should be noted, however, that the operation of cluster initiatives is not a prerequisite for the operation of clusters in the economic space (scenario 1). The most accurate example of a cluster with no parallel cluster initiative is the Silicon Valley [Sölvell et al. 2003].

Cluster initiatives may be formed in line with one of two approaches: top--down and bottom-up. The criterion of that distinction applies to the type entities whose activities form the core of the cluster initiative. Thus, companies (the bottom-up approach) or the representatives of the public sector (the top-down approach) may be the source that initiates the process of institutionalization, and consequently directs the operation of the initiative. The dichotomy between these alternatives determines the manner of organizing initiatives and management processes [Fromhold-Eisebith and Eisebith 2005].

Promoters of cluster initiatives, i.e. those responsible for their management, are usually enterprises, representatives of government organizations, founders (international agencies of donors or international consultants) or other entities. Sölvell et al. [2006] conducted a survey of 1,400 cluster initiatives, which outlines the variety of solutions in cluster initiatives in economies at different levels of development, managed by different groups of actors [Sölvell et al. 2006].

Organizations whose activities may affect the functioning of clusters may also be ranked according to the criterion of the degree of clarity of their policies. Fromhold-Eisebith and Eisebith [2005] propose to distinguish between two groups of actions to promote clusters: the explicit and the implicit approach. The first one includes those organizations which are established under the aegis of clusters, based on the theoretical framework developed by Porter. The other one includes those activities whose goals are consistent with the goals of the cluster based policy, and the activities carried out by them are not officially, and sometimes consciously, connected with the concept of clusters [Fromhold-Eisebith and Eisebith 2005]. Table 1.12 summarizes alternative categories of actions for the promotion of clusters.

Group 1 (explicit top-down) includes activities that are knowingly made in support of cluster structures. In addition, the main actors are representatives of the private sector. Another group – implicit top-down – revolves around the actions of entrepreneurs, as in the previous case. The difference between them lies in the purposes for which they were created.

For the implicit top-down category, actions are not necessarily taken directly with regard to their impact on clusters, while the explicit top-down category includes those activities that are undertaken in order to support the development of clusters. The next two alternatives to promote clusters have a common denominator with regard to the criterion of the entity.

Table 1.12. Categories of activities for the promotion of clusters

ACTORS	CLARITY	
	EXPLICIT	IMPLICIT
TOP-DOWN	*explicit top-down* (1)	*implicit top-down* (2)
BOTTOM-UP	*explicit bottom-up* (3)	*implicit bottom-up* (4)

Source: Own elaboration based on Fromhold-Eisebith and Eisebith 2005.

The third and fourth groups include activities promoted by representatives of the public sector, e.g. of the local government. The difference between them results therefore from the second of the adopted criteria, i.e. from the degree of clarity of the policy pursued in terms of the theory of clusters. The explicit bottom-up approach refers to initiatives whose objectives pertain directly to clusters, while the goals adopted within the implicit bottom-up approach usually only indirectly affect the functioning of clusters in the economic space.

Cluster initiatives go through several stages of development in their life cycle. The starting point is the so-called "existing condition". This period consists of all kinds of activities and their institutionalizations, which have a significant impact on future cluster initiatives. At the next stage a cluster initiative is generated, usually initiated by representatives of one of the three groups of stakeholders: entrepreneurs, government or the academia. In some cases, after some time cluster initiatives evolve into formal structures [Sölvell et al. 2003].

Research into cluster initiatives is largely based on the model of their performance proposed by Sölvell et al. [2003]. The model includes elements that play a major role in the formation, operation, and in some cases extinction of cluster initiatives (Table 1.13).

The model consists of four elements; the leading three determine the fourth one, i.e. the results. The results achieved are determined by the environment (the context for the operation of cluster initiatives), processes (which explain how initiatives are formed and developed) and objectives (which guide the actions undertaken).

Table 1.13. Model of cluster initiatives

ENVIRONMENT:	PROCESS:	OBJECTIVES:
• Business environment • Policy • Cluster strength	• Initiation and planning • Management and funding • Scope of membership • Resources and promoters • Framework and agreement • Momentum	• Research and networking • Activities in the field of policy • Trade cooperation • Education and training • Innovation and technology • Expansion
RESULTS: COMPETITIVENESS GROWTH ACHIEVEMENT OF OBJECTIVES		

Source: Own elaboration based on Sölvell et al. 2003.

2. Key conditions for the emergence and development of agri-food clusters in Poland

2.1. Economic conditions

The economic conditions for the formation and development of clusters may be seen as sources of competitive advantage that lead to the emergence and development of clusters and their achievement of competitive advantages [Porter 1998a, 1998b]. They include interacting factors which – with reference to the analytical convention of Porter [1998a, 1998b] – may be divided into supply, demand and structural factors. Supply-side factors include:

- the quality and cost of natural, capital and human resources;
- the quality and cost of material and non-material infrastructure to facilitate access to resources and support the activities of enterprises (administrative, legal, information, scientific and research infrastructure, social factors related to the quality of life of the sector community such as security, order, or leisure opportunities);
- regulations on international trade and foreign investment;
- resources that come from outside the sector together with foreign investment;
- formalized social relations;
- informal social relations (an atmosphere conducive to business activity and work, and unspecified, informal relationships associated with vertical trade contacts between enterprises).

Demand factors include:

- demanding and sophisticated local customers that force companies to improve continuously;
- existing and future customer needs, satisfied by segments outside the cluster;
- local demand, which reveals market sectors where companies can differentiate (specialize), with the quality of local demand more important than the actual size of the market;
- barriers related to entry in foreign markets, and export regulations;
- unforeseen events in the global market, which may increase the demand for the products of the sector;
- external markets;
- social factors related to formal social relations.

Also structural factors, which shape the context for the strategy and rivalry of enterprises and the strategies of related and supporting industries, may be an important source of competitive advantages. Factors that affect the context

for strategy and rivalry include legal standards and regulations, as well as incentives and standards that determine the type and intensity of competition between local companies in a given sector, in particular:

- the local context that encourages appropriate forms of investment and supports modernization;
- strong competition between local rivals;
- the structure of the tax system;
- business management systems;
- labour market policies;
- provisions on intellectual property rights;
- local policy on anti-trust and anti-corruption activities.

In general, poor competition in a given sector or industry entails a low efficiency of enterprises, a lack of innovation and, in addition to imitation, a minimum level of investment focused only on material resources. An important role in this respect is also played by related and supporting industries, which include local suppliers and enterprises from related industries which provide complementary services to the activities of enterprises from a given industry. It is worth noting that factors related to formal social relations are also important.

Analysing the sources of competitive advantage allows for evaluating the competitiveness of a sector in terms of its strategy and in terms of strategies of individual enterprises. Examination of the properties of the forms of organization in the sector provides an explanation of the mechanism of how enterprises gain and maintain competitive advantage. In turn, the existence of interconnections within and between the sources of competitive advantage can compensate for the deficiencies in the potential of the sector and allow for a better utilisation of those that distinguish it.

The study of the sources of competitive advantages of a sector is often referred to as the structural analysis of the sector. Importantly, although in each sector, the development of competitive advantages is influenced by different forces, some of them are essential. In the agri-food sector, probably the most important of those include the bargaining power of buyers and potential entering entities (sectors from other countries); in relation to particular industries of the sector, competitors are the major force in the sector (e.g. for a particular producer of pork these will not only include other pork producers, but also producers of poultry meat).

By examining the structure of the sector, the focus should also be on the analysis of the severity of the various competitive forces rather than only on the analysis of the factors that may temporarily affect competition and profitability. Such factors include, for example: fluctuations in economic conditions in the economic cycle, shortages of raw materials, strikes, periodic sudden increase in

demand. It is more about the basic economic and technological features of a given sector rather than identifying factors that have a short-term impact on the profitability of all sectors, since structural analysis is used for strategic rather than tactical decisions, and its purpose is to understand the structure of the sector.

This paper is not devoted to the structural analysis of each of the branches of the domestic agri-food sector, but to the assessment of the conditions for the formation and development of agri-food clusters in Poland. Thus, the analysis presented in this section concerns supply, demand and structural conditions for the entire agri-food sector. The individual industries of this sector will only be invoked as examples, with no separate discussion.

2.1.1. Supply conditions

The key supply-side conditions for the growth of agri-food clusters include land and other natural resources, labour resources, the availability of capital and direct foreign investments, information and research and development infrastructure and opportunities in the field of international trade. Poland ranks ninth in Europe in terms of area and eighth in terms of population. Located centrally in Europe, it has a rich history of agriculture. Against population, the 15.5 million hectares of agricultural area should be considered relatively big. Arable land area per capita is 30% greater than in the EU, which allows it to be used less intensely. Land prices are moderate, ranging from about PLN 10 thousand per ha (low meadows) to about PLN 21 thousand per ha (good wheat-beet soils). The opportunities for using agricultural land are multidirectional [Jabłońska-Urbaniak 2010]. According to the agricultural census of 2010, 68% of the total area of agricultural land was under sowing, 2.3% were orchards, and 21% pastures [CSO 2011]. The quality of land is greatly diversified, but in general it can be concluded that arable land is of relatively good quality. The best wheat-beet soils are in Żuławy, Kujawy, Lublin Upland, Roztocze, in the Sandomierz Basin and in Silesian Lowland. In central Poland, on the other hand, there are predominantly weaker rye-potato soils. Vegetable and fruit crops are mainly located in the vicinity of large cities (e.g. Warsaw, Gdańsk, Szczecin, Katowice, Kraków, Bielsko-Biała, Wrocław, Wałbrzych). The poorest soils with crops of barley, oats and fodder crops are mainly in the southern part of North-Eastern Poland and in Pomerania. Also, the terrain is characterized by a high degree of diversification, taking the form of lowlands, highlands, mountain and foothill areas and deltas. The growing season is more than 200 days, and majority of arable land is located in areas with adequate rainfall. Unfortunately, where precipitation is insufficient or excessive, there is a problem of the negligence of irrigation systems. This is espe-

cially important now, as more and more floods and droughts occur in the spring, and excessive rainfall and hail in the summer.

In Poland, there are favourable conditions for both crop and livestock production. Regional differences in the nature of agricultural production are mainly due to the different natural conditions, in particular to soil quality. There are a number of different crops and types of farming. Poland also has a rich tradition, now often recreated, in the processing of food. Our country almost avoided the very negative consequences of animal diseases such as the BSE or avian and swine flu. The environment is little polluted. There are even places practically completely free of industry, such as Roztocze, Bieszczady. Principles of cross-compliance apply to most agricultural land, and monocultures are practically non-existent. The level of biodiversity is also relatively high.

Polish food products are considered to be of very good quality (e.g. meat products and cold meats). With small doses of fertilizers per hectare, Polish raw materials for food production are relatively good and cheap. There are also increasing areas under the organic farming system. In 2010, it was 518.5 thousand ha. The organic production method was used in almost 21 thousand farms. The average annual growth of agricultural land under organic production in 2003-2008 was 40% [Więcek 2011]. Against Europe, the position of Poland in organic farming is getting better.

Labour resources in Polish agriculture are relatively large. It employs about 2 million people (about 12 persons per 100 ha), representing 14.7% of total employment, compared to 5.8% in the EU [Sawicki 2011]. Over the past 20 years, the Polish countryside depopulated mostly as a result of domestic and international economic migration. Currently, half of land owners receive income from employment outside agriculture. More and more rural residents and farmers take up business activity. Non-agricultural economic activities are pursued by 7.5% of the rural population and about 4.5% of farmers. In rural areas there are 892.5 thousand enterprises engaged in non-agricultural activities, including 115.2 thousand enterprises on farms [Więcek 2011].

The number of farms in Poland is steadily declining (within 40 years it was reduced by 1/3), while their area is increasing. Recently, the dynamics of these changes has been weakened. Poland ranks second in Europe in terms of the number of farms, which was 2.28 million in 2010. Of that number, 1.89 million engaged in agricultural activities. The structure in terms of area is dominated by very small farms of up to 1 ha (31.4%) and small farms of 1-5 ha (37.9%) [CSO 2011]. The high competitiveness and a strong export position of Polish agricultural production are mostly due to many thousands of large farms. Farms of over 15 ha hold ca. 50% of all agricultural land. In the period 2002--2010, the average farm size increased by 13%, while the number of small farms

(with an area of less than 5 ha) decreased by 23% [Sawicki 2011]. Agricultural land goes not only to the largest farms, but increasingly often it is taken over by the rural elite professionals and managers. At the same time, many farmers remain on unprofitable farms and the labour market does not absorb hidden rural unemployment. In Poland, there are still resources of relatively cheap workforce engaged in labour-intensive crops (e.g. fruits, vegetables), but they are shrinking rapidly. It should also be noted that the income of farms of over 10 hectares and small farmers who depend on off-farm employment is growing.

The capital equipment of Polish farms is highly varied depending on their size. Favourable changes that have taken place in this area in recent years are mainly related to Poland's accession to the EU. Under the CAP, farmers receive direct payments (per ha) and are eligible for funding under many programmes of the second pillar (Rural Development Programme), although the application process is rather complicated. The RDP distributes funds for improving the competitiveness of the agricultural and forestry sector, improving the environment and the countryside, improving the quality of life in rural areas and diversifying rural economy, creating local action groups, and for technical assistance. In 2004-2013, the budget to be used within the programme amounts to approximately EUR 31 million [Jabłońska-Urbaniak 2010].

In recent years, significant progress has been made in the technical infrastructure of farms, in quantitative and qualitative terms. However, there have been few initiatives for joint investments, e.g. within producer groups, so that equipment could be used more effectively and economies of scale achieved. When it comes to enterprises in the agri-food sector, they can obtain structural funds for [PriceWaterhouseCoopers 2008]:

- grants for investments using innovative technology, research and development and implementation of their results, large investment projects in the manufacturing sector (over EUR 40 million);
- grants for general and specialist training, open or closed, for the management and employees of enterprises, co-financing for postgraduate studies within the Human Capital Operational Programme;
- grants for investments to adapt enterprises to environmental requirements (including environmental management systems, waste management, implementation of best available techniques, water and sewage management, air protection), investments in renewable energy sources under the Operational Programme Infrastructure and Environment;
- grants for investments and other development projects worth up to EUR 2 million for various purposes depending on the needs of the voivodeship un-

der Regional OPs (investments were also co-financed by pre-accession grants under SAPARD).

It is possible to obtain the technology credit as well. It is granted by the Bank Gospodarstwa Krajowego (BGK) under conditions similar to market conditions, but with the possibility of partial redemption. Its value is maximum EUR 2 million. It can be designated for implementing one's own technology or buying it if it has not been used in the world for more than five years, and for launching production of new or improved products based on that technology, or the provision of new or improved services. The exemption from property taxes is provided by communities as part of regional aid, which aims to encourage new investment and create new jobs associated with new investment. The level of assistance depends on the area where the investment will be carried out, in accordance with the current regional aid map. The amount of aid is calculated for investors individually, based on investment costs and salary costs. To obtain it, one must meet specific conditions, e.g. create new jobs within three years from the completion of the investment and maintain them for five (large firms) or three years (SMEs) [PriceWaterhouseCoopers 2008].

Mainly due to the accession to the EU, the Polish food sector has been greatly improved in recent years, it was better promoted, and with flexibility, awareness of the risks and opportunities, the pro-export attitude and finding gaps in the range of goods, it competes with global giants. In many industries, the technological level is not inferior to world standards. However, there are cases of overinvestment, which results in the installed capacity significantly exceeding sales capacity. Also the growing prices of agricultural raw materials and market pressure on the part of retailers are a threat to the viability of the sector.

The agri-food sector is increasingly confronted with greenfield investments and acquisitions and privatizations involving foreign investors. Investors are interested in investing in Polish enterprises mainly due to the fact that after accession to the EU, Poland has become a very attractive and safe place for business investment. Moreover, Poland has been effectively resisting the current crisis and as one of the few EU countries continues to post relatively high economic growth. In 2011 alone, five investors invested 83.5 million in the food industry, creating 662 jobs. Often highly qualified managers and specialists also come with the foreign capital. Most projects are located in special economic zones, and most of the capital flows to the food industry from the Netherlands, UK, USA, Germany and France. Capital is invested primarily in the production of stimulants and secondary processing (i.e. tobacco, confectionery, beer and non-alcoholic drinks), and the least in the processing of animal and vegetable products [Ministry of Labour and Social Policy 2003].

With FDI, Poland has made significant progress in terms of renewal and expansion of production assets, agricultural processing plants have been modernised, exports has increased and access to international distribution networks has been facilitated. In addition, there has been an increase in the degree of processing of agricultural products, increase in productivity, and stimulation of the economic infrastructure development. FDI played a special role prior to accession to the EU – by 2004 the Polish food sector received investments of USD 6,624.8 million (mainly due to privatization). Currently, foreign investments and resources flowing with them are seen less as a development factor and more as competition to the rapidly developing domestic enterprises (with the exception of areas with high unemployment) [Ministry of Economy and Social Policy, 2003].

Being a member of the EU, Poland applies the common organization of markets, including the agricultural market, to implement the objectives of the CAP. The common rules on competition are complied with. The aim is to control and reduce production while ensuring an adequate level of income for farmers. EU agriculture is one of the most regulated industries. EU law regulates within the co-existent types of interventions in agricultural markets [Czyżewski and Henisz-Matuszczak 2006]:

- intervention in the internal market and external protection (including the market of cereals, sugar, dairy products, beef, certain types of fruit and vegetables, table wine – together about 70% of agricultural production; the EU guarantees outlets and minimum prices; the surplus is bought by authorized agencies and directed to public reserves, during shortage the agencies sell products within the EU; each product has its own market organization and rules of procedure; procurement price is determined by way of tender; flexible rules in the pork market, table wine, some fruit and vegetables, with mainly financial aid for private storage – subsidies for the cost of storage relieve from excess surpluses and stabilizes prices);
- external protection without internal intervention (rapeseed, sunflower, soy, eggs, poultry, processed fruit and vegetables, quality wines, tobacco, hops, seed, flowers – together 25% of agricultural production; protection through tariffs and levies, the safeguard clause in case of occurrence or threat of market disruption, certificates combined with the payment of deposit, import licenses for sensitive products – one needs to specify the amount of allowable imports, minimum import price, period of implementation);
- direct payments to agricultural production or through the processing industry (products for which direct or indirect financial assistance to producers applies, including assistance for the processing industry, which undertakes to pay the minimum price for farmers; subsidies to industry concern products for which EU bound its tariffs at the WTO, which prevented external protec-

tion; recently subsidies were used for olive oil, tobacco, cotton, wheat; support for processing branches which process agricultural raw materials for technical purposes and undertake to pay domestic suppliers prices higher than the prices in the international market, e.g. distillation of wine, production of starch, casein, sugar processing; subsidies for processing apply to 2.5% of production);

– direct flat aid per hectare, head, growth or volume of production (producers of flax, hemp, silkworms, hops, dried fodder; increase in the significance of this form of support; instrument of stabilization and improvement of agricultural incomes; bonuses for heifers and suckler cows).

The Agricultural Information System (AIS) is a key element of information infrastructure in Polish agriculture; it should perform the following functions: describing entities and objects, events and processes in the agricultural market; forecasting future events and market processes; supporting the creation of new solutions in the area of market products and operations; evaluating the effectiveness and efficiency of CAP measures and the quality of work in their implementation (descriptive, predictive, innovative, and controlling functions) [Rembisz and Idzik 2007].

R&D infrastructure is created by a number of different entities. Research for the sector is carried out by thirteen R&D units subordinate to the minister of agriculture, but also nine research centres of the Polish Academy of Sciences and universities (with 47 faculties) supervised by the minister for science and higher education [Jabłońska-Urbaniak 2010]. Six of the R&D units have the status of the National Research Institute: the Institute of Agricultural and Food Economics, the Institute of Soil Science and Plant Cultivation, the Institute of Animal Production in Balice near Kraków, the National Veterinary Research Institute in Puławy, the Institute of Plant Protection in Poznań and the Plant Breeding and Acclimatization Institute in Radzików. The issues in agricultural sciences are explored in some units subordinated to the ministries of economy, environment, health and labour.

The financial resources for the purposes of R&D are derived mainly from the budgetary grants of the MSHE, and as a result of reducing the allocation for statutory activities, additional funds are derived from participation in international scientific and technical cooperation programmes, tasks assigned by the business sphere, but also from loans and leases [Jabłońska-Urbaniak 2010]. Some units receive funding from the MARD for the implementation of multi-annual programmes. Currently, there are eight such programmes aimed mainly at monitoring the transformation processes in the sector and setting quality standards for the production of safe food.

EU has freedom of movement of goods between Member States. Also Poland is part of the common market. Member States do not conduct their own trade policy with third countries, but are represented by the EU institutions under the common trade policy. The agricultural sector is additionally covered by the Common Agricultural Policy, which governs not only agricultural production, but also trade in agricultural products. In addition, states have the instruments available in the framework of national policies, which, however, are constantly reduced. As a result, trade within the EU and beyond its borders is controlled directly or indirectly by means of the following instruments [Czyżewski and Henisz-Matuszczak 2006]: the price intervention system, creating state reserves, direct subsidies to market prices, intervention buying and stocking system, customs (ad valorem, specific, combined, conventional, contractual, preferential), export subsidies, levies, quotas, sales tax, quality and technical standards, standardization of products, direct and indirect subsidies, preferential loans, acreage reduction, loans to finance inventories, import and export licenses. These instruments change significantly at the same time. It can be said that despite the freedom of movement of goods, in Poland, under existing EU and national regulations, there are some important limitations on the quality and volume of production and consequently on trade.

2.1.2. Demand conditions

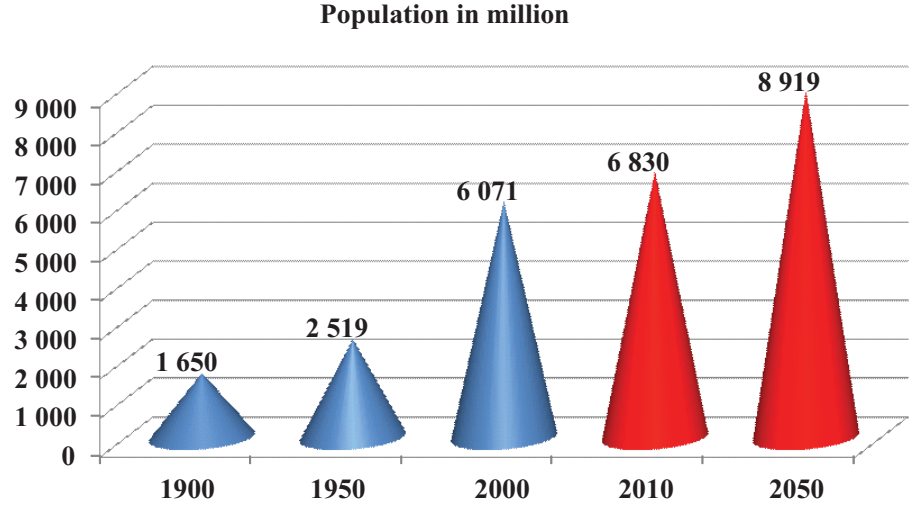
In global or macroeconomic terms, the demand for food is determined by the population and the level of income[9]. Regardless of the assumptions underlying the various demographic forecasts, it is expected that by 2050 the world population will continue to grow. In the most likely scenario, according to data published by the United Nations, it will reach 9 billion (Figure 2.1.).

On the other hand, when it comes to personal income in the world, which is a derivative of the productivity of individual economies, the changes in the level of GDP in large countries regarded as poor so far will be of crucial importance. In a synthetic way, one can treat them as a result of specific economic competition of G7 countries (USA, Japan, Germany, United Kingdom, France, Italy and Canada) and the E7 group (Brazil, Russia, India and China – countries known as the "BRIC" – and Mexico, Indonesia and Turkey). According to long-term forecasts of global economic growth by PriceWaterhouseCoopers, in 2050

[9] Comprehensive discussion on this issue can be found in the works by S. Figiel and W. Rembisz *Przesłanki wzrostu produkcji w sektorze rolno-spożywczym – ujęcie analityczne i empiryczne* and W. Rembisz, A. Sielska and A. Bezat *Popytowo uwarunkowany model wzrostu produkcji rolno-żywnościowej*, published respectively in 2009 and 2011 by the IAFE-NRI in Warsaw.

countries from the E-7 group will have a product 50% greater than those of the G-7. It is also expected that in 2025 China's domestic product will be greater than that of the USA, and in 2050 the same may be true for the domestic product of India.

Figure 2.1. Occurring and forecasted changes in world population in 1950-2050



Source: Own elaboration based on data from the United Nations.

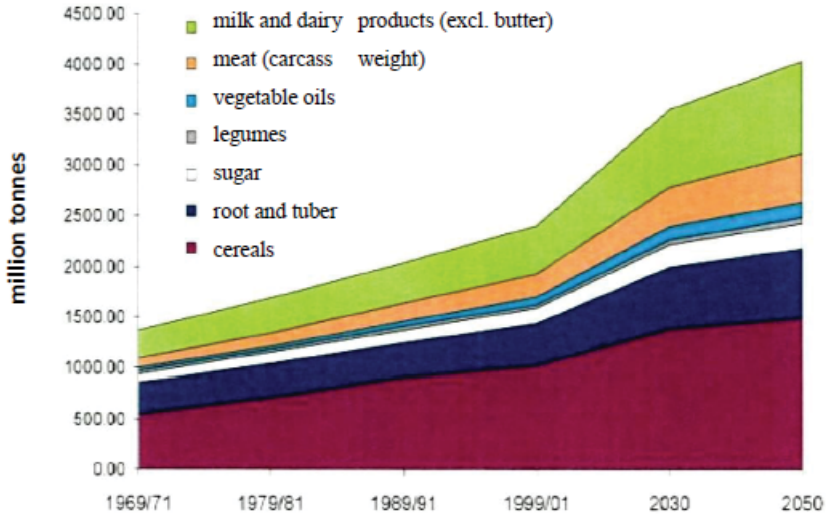
These changes will have consequences on the level of GDP per capita, as well as on the income and demand for food. It can therefore be assumed that both the increase in world population and the wealth of societies, particularly in big and relatively poor countries, will inevitably lead to increased global demand for food (Figure 2.2.).

In Poland, expenditure on food and non-alcoholic drinks is a major item in the structure of household expenditures. In 2010, their share in the total expenditure amounted to 24.8%. However, according to many authors, we should not expect, even with an increase in the wealth of Poles, that food consumption in Poland will grow. Due to the change in food prices, its share in household expenditure may rise. It is also possible that the structure of consumption will change due to changes in fashion and consumer tastes. In the shorter term, also events such as the financial crisis, avian or swine flu, the BSE, or scandals related to the quality of organic food are not without significance.

As for the trends observed in the last 20 years in Poland, in general we consumed more fruit, poultry meat, vegetable fats, fish, and less animal fats,

sugar and milk. The level of total meat consumption remained relatively stable, while the consumption of beef, sheep and goat meat decreased, and poultry meat consumption increased, with the consumption of pork relatively constant. In the last decade of the last century, the consumption of grain products per capita in Poland was among the highest in Europe [Borowska 2002]. However, for a long time domestic consumption of bread and other baked goods is steadily decreasing.

Figure 2.2. Forecasted increase in demand for major agri-food products



Source: Giejbowicz 2011.

The analysis of the demand conditions for the creation and development of agri-food clusters must also take into account the qualitative aspects of the demand for food, which is especially important in affluent societies. Behavioural patterns of those societies reveal specific megatrends, such as the convenience of consumption or interest in the security and health status of food. Consumers are paying increased attention to the form and quality of consumed food. There are also new groups of consumers with preferences previously unobserved or of little importance to the market. In accordance with Porter's approach [1998a, 1998b], with regard to the agri-food sector one can indicate a variety of demand sources of potential competitive advantages that determine the creation and development of agri-food clusters in Poland. To put it in somewhat subjective terms, they can be classified as:

– demanding and increasingly sophisticated local customers that force enterprises to continuously improve their market offer:
  ✓ enthusiasts of health and taste quality;

  - ✓ vegan children, those disproportionately burdened, starving for life, caffeine crazies, etc.;
- existing and future customer needs met by other sectors related to the agri-food business:
  - ✓ the need to deliver products directly to home, wider access to online ordering and group purchasing;
  - ✓ the desire to help other people when buying a given product (farmers, producers of the product, domestic producers, or others through charity actions associated with sales);
  - ✓ the overall need for information on the conditions and place of production, etc., instead of advertising;
  - ✓ the need to buy Polish products considered as healthier due to the good environmental conditions;
  - ✓ the need for sustainable packaging;
  - ✓ the need to consume food with a higher content of vitamins and minerals;
  - ✓ the need for short information on nutritional properties of products to be provided (e.g. fruits, vegetables);
  - ✓ the need for greater amounts of natural additives in the production of various goods (in cosmetics, for example);
  - ✓ the need to provide various recipes for the preparation of dishes for specific products;
  - ✓ the need for contact with nature, as well as contact and dialogue with the food producer;
  - ✓ the need for modern places to shop for original products supplied directly by Polish producers;
  - ✓ the needs met by foreign products unavailable in Poland (e.g. Spanish ham, Dutch cheese with additions, French bread, etc.);
  - ✓ the needs of Polish and foreign tourists (mostly city dwellers) interested in the Polish countryside landscape, leisure and contact with people who live in harmony with nature;
- local demand that reveals different market segments, so that enterprises can specialize or integrate vertically:
  - ✓ specialization in the production of low-cost products or more expensive products of higher quality, which implies different marketing strategies;
  - ✓ vertical integration of enterprises, relations between small facilities that provide semi-finished products and the processing industry;
- barriers related to entry to foreign markets and export regulations:
  - ✓ capital resources needed to undertake expensive and risky investment projects;

- ✓ prevalence of various forms of financing activities and investments (e.g. leasing, joint ventures, business angels, etc.);
- ✓ low level of cooperation between companies that represent a given industry;
- ✓ insufficient promotion of Polish products in foreign markets;
- ✓ the lack of proper identification of markets outside the EU, with simultaneous focus on EU markets;
- ✓ high standards and quality requirements applicable to EU markets;

– development of external markets:
- ✓ growing interest in high quality Polish products in the EU;
- ✓ growing demand for food in large rapidly developing countries (e.g. China);
- ✓ the popularity of Polish food in Polish communities abroad (e.g. USA, Canada, United Kingdom);
- ✓ the positive image of Polish food as a result of export success of domestic companies operating in foreign markets;

– supply-side flexibility in responding to changes on the demand side, including changes in consumer behaviour:
- ✓ conditions for the development of short supply chains;
- ✓ cooperation between entities in marketing chains (e.g. market research, joint campaigns and promotional activities, etc.);
- ✓ ability to meet the needs of consumers who look for high quality products for the lowest possible price;
- ✓ the degree of product diversity;

– sudden, unexpected events in the global market, which have a significant impact on the demand for products of the domestic food and agriculture sector:
- ✓ natural disasters (droughts, floods, etc.);
- ✓ diseases, outbreaks or contamination of products in food supply chains which are difficult to control.

From the perspective of the development of clusters in the Polish agri-food sector, a more detailed discussion should be devoted to the emerging category of demanding and sophisticated consumers. Global trends reach Poland; a very interesting list of those trends was compiled by Penn and Zalesne, highlighting the following microtrends [Penn and Zalesne 2009]: vegan children, disproportionately burdened, starving for life, caffeine crazies.

The first trend is associated with the fact that there are no longer classic dinners consisting of meat and potatoes, and meals for children are increasingly meatless. This trend is clearly visible in the USA, where about 1.5 million children aged 8-18 years old are vegetarian, and another 3 million do not eat red

meat [Penn and Zalesne 2009]. The reason for the existence of that trend is an overall increase in parental permissiveness and nurturing individualism at all ages [Penn and Zalesne 2009]. Today, children are not reprimanded, punished, or forced to eat meat, but rather praised for independence and sensitivity to the plight of animals. Their decision to switch to vegetarianism has nothing to do with practicality, tolerant parents, but rather with teaching children the approach to the environment. Examples include Earth Day, encouraging segregation of waste and taking care of stray animals. The voice of children in many families is one of the loudest and most unfettered. They are the ones to teach parents to segregate waste, tell them about the negative effects of smoking. Today schools teach nothing about hunting, fishing, raising chickens. What is most striking, however, is that children do not want to eat animals because in the literature animals are objects of children love. Human beings appear only in the literature for teenagers. As a result, even the most nutritionally conscious parents are no longer able to convince children to eat animals. On the other hand, nutritionists themselves increasingly recognize that a vegetarian diet for children can be just as good or better. Male vegetarians are 37% less at risk of heart diseases and the risk of dementia, regardless of lifestyle among vegetarians of both sexes is reduced by 50%.

Another global trend is the increase in the average weight of women and men, named "globesity" by the World Health Organization. Currently 925 million people starve in the world, including more than 40 million of poor people who continue to experience the shortage of food (malnutrition) in Europe, while more than one billion people are overweight. The number of obese people (13 or more kg overweight) means now more than 300 million who are at risk of obesity-related heart disease, heart attack, diabetes, or hypertension [Penn and Zalesne 2009]. In connection with this paradoxical phenomenon, some industries even thrive. This primarily applies to fast-food restaurants, but also the weight loss industry. Many governments and organizations have announced action plans to reverse this negative trend. Labels include mandatory calorie information, restaurants provide information on the principles of proper nutrition. At the same time, obesity medications continue to improve, and in some countries surgery to reduce weight will probably be funded from public sources.

The "starving for life" trend, in turn, determines the group of people who "disappear", which is not due to illness, preferences or political protest, but the conscious pursuit of a longer life [Penn and Zalesne 2009]. The number of followers of this diet is not great, but it is constantly growing. Instead of 2,500 calories, they eat an average of 1800. They do not follow a specific diet, they just eat little, mostly fruit, vegetables, nuts and sprouts, etc. This trend seems to be attractive for two reasons. First, it is something of a secret society whose mem-

bers believe in the meaning of their actions, they are happy with themselves, knowing that others slowly kill themselves by eating.

Secondly, their goal is not to be thinner, but to live longer, which is a paradigm shift, and is particularly significant for people who decide to have children around 40 years of age and in addition they want to get to know their grandchildren. This trend may be important and change the attitude to food consumption. In the face of this, restaurants will have to provide information about the number of calories, there will be an increase in the demand for functional food, enriched with additional vitamins and minerals. People who starve themselves in the name of a longer life will not want to pay for overweight people with, in their approach, too carefree attitude to life. It is also worth mentioning here that, historically speaking, different cultures alternately favoured stout or slim silhouettes. What remains unchanged is the more and more intense desire to prolong life. If calories reduction actually contributes to that, it could mean drastic changes in the market for food production.

The last of the rarely identified trends which is worth noting is the group of caffeine crazies [Penn and Zalesne 2009]. In addition to the huge and growing consumption of bottled water, which has become the prevailing fashion, there are derivative products. Water is enriched with the so-called functional additives, i.e. vitamins, minerals, flavours, etc. A product with such additives sells faster. At the same time, there is an increasing interest in coffee. The income of Starbucks or Coffee Heaven has been steadily increasing over the past few years. Their youngest customers are 10 years old. In addition, carbonated soft drinks and juices are becoming more and more popular; they are ahead of white bread as the main source of calories in the diet. The sales of tea are increasing. However, the fastest-growing segment of beverages is energy drinks. For example, in the USA in 2006 alone, 200 such beverages went on the shelves, contributing to the growth of the industry by 50%. Red Bull beats sales records and the trend continues. Beverages with more and more caffeine content are promoted. There is the belief that with caffeine athletes are fitter, drivers can get to their destination, and the risk of Alzheimer's disease, diabetes, gallstones, Parkinson's disease, or colon cancer is reduced. It is also believed that caffeine supports the effects of medication, improves memory and learning ability.

An established, fairly strong trend in the well-off EU that is becoming increasingly stronger in Poland is the growing interest in healthy food produced organically. In general, the demand for high quality food is increasing. Quality can be understood in two ways [Giejbowicz 2011]. First it is the health quality, which means:

– control and monitoring of the growing-farming-processing-transport-retail chain;

– traceability of the origin of foods and food ingredients, and monitoring their movements in the supply chain;
– certification of organic products.

Secondly, it is the quality of flavour. As a result of devoting more attention to the quality, there is a growing interest in products that have quality certificates, certificates of regional or traditional food, as well as original, little-processed products purchased directly from the farmer. The group of organic product lovers – where chemicals are not used – is also expanding. However, these are more expensive products for a relatively small percentage of affluent consumers.

Considering the demand-side determinants of the development of agri-food clusters, one cannot ignore the issues related to the production and the way of buying food. Firstly, more conscious consumers interested not only in the price but also in quality, more and more care about animal welfare, good agriculture and the conservation of biodiversity. Secondly, although much of the food is bought in supermarkets and hypermarkets, consumers more often visit fairs organized in city centres or in closed streets, buy food online, order services of steady supply of fruit and vegetables, or purchase directly on farms or at farmer's stores. They increasingly prefer fresh and less processed produce, small portions and dishes ready for consumption. Appropriate packaging and appropriate processing of the product becomes more and more important.

A notable phenomenon which affects the demand for agricultural products is the growing importance of renewable energy and biofuels. This trend is related to the EU decision of 2007 on the 20-20-20 objective. The European Council announced a 20% decrease in greenhouse gas emissions by 2020, as compared to emissions in 1990, a 20% increase in the share of renewable energy in final energy consumption, a 20% improvement in energy efficiency (decrease in the use of primary energy), and a 10% share of biofuels in transport fuel consumption to be reached in 2020. Each of the Member States has adopted different objectives, taking into account the differing circumstances. Plans under Polish energy policy until 2030 include improving energy efficiency, increasing energy security, developing renewable energy sources, including biofuels, developing competitive fuel and energy markets, reducing the impact of energy on the environment [Jabłońska-Urbaniak 2010].

2.1.3. Structural conditions

Porter singled out the following structural determinants of the intensity of competition: competition between local rivals, the threat of new entries, the pressures associated with substitutable products, the presence and strategies of local vendors from competitive, related industries [Porter 2010].

Agri-food sectors in different countries in the areas of selected industries compete with each other, using different methods, including price competition, advertising campaigns, introduction of new products, wider range of customer service, warranties, etc. Reaching for these methods is either a necessity or an opportunity to improve one's own position. Industry activities from one country result in counter-activities by companies in other countries. Usually, they decide to retaliate or carry out neutralizing activities. Companies in these industries are mutually dependent. The game conducted between them can improve the situation of the industry in the country, but it often happens that the entire industry is in a worse condition. In particular, price competition may reduce the profitability of the entire industry (e.g. the poultry industry). In turn, the advertising campaigns often contribute to an increase in demand and a greater variety of products, which can benefit all parties. An example would be in the sector of milk products (such as yogurt, cream cheese).

In most industries of the agri-food sector, there is a domination of given countries, or in the case of processing – companies. These leaders often impose discipline and play a coordinating role, for example, they are responsible for fixing prices. Competition in the agri-food sector, due to the relatively stable demand, transforms into a game to increase market share. Consequently, the situation is not as stable. In addition, the high fixed costs put pressure on the full use of production capacity in processing plants, but also on farms. The storage of products is difficult and costly; sector companies lower prices to ensure sales, which translates into a reduction in earnings across the sector.

Competitors of the Polish agri-food sector differ in strategy, origin or character. In every industry there are different goals and competition strategies. Companies that compete in the agri-food sector have therefore difficulties in reading each other's intentions and rules of the game. Strategic choices appropriate for one competitor often turn out to be inappropriate for another. Especially foreign competitors bring a lot of variety to competition. Small businesses often decide for a below-average rate of profit, because it is more important for them to maintain the independence of ownership of the company. This action taken by small companies reduces the profitability of larger companies, where such rate of profit is not acceptable. In many industries of the agri-food sector, there are also companies that use dumping prices, considering the particular market as a place for disposing of surplus production, while for other companies it is the primary market. Competition in the agri-food sector is further exacerbated by companies whose strategic activities involve gaining certain markets in order to diversify the business, achieve prestige or technical credibility.

The agri-food sector is one of the sectors with a low rate of profitability. Both the processing industry and agriculture cannot count on the margins com-

parable to the sectors of services and high technology. However, the companies, despite the low rate of profit, stay in their industries. The reasons are the following problems (of economic, strategic, and even emotional nature) in exiting a given sector, called exit barriers [Porter 2010]:

- resources with a high degree of specialization, associated with specific activities or specific location, with low values at their liquidation and high costs of transfer, e.g. processing plants;
- fixed exit costs, including collective bargaining agreements with employees, production maintenance costs and ensuring spare parts;
- strategic interdependencies between a given unit and other units, important in terms of prestige, shared facilities, access to capital markets;
- identification with a particular line of business, loyalty to employees, fear for one's own career, pride;
- government bans and other restrictions that follow from the care of the state to maintain jobs or potential economic impact for the region.

Thus, high exit barriers contribute to the struggle of companies to stay on the market, often using extreme tactics, e.g. by lowering the quality of the product.

The threat of new entries depends on the barriers to entry and the response of competitors on a given market. It is small when the barriers are large and the reaction of competitors is fierce. New players that enter the industry bring new production capacity and significant resources. They aim at gaining a market share, which results in lower prices, rising costs, and reduced profitability. Companies that diversify their activities often buy companies in other markets where, using their resources, they change market situation.

In general, barriers to entry in the case of the Polish agri-food sector are relatively low. This means that reaping the benefits of the new solutions is not free from the fear that the new competitors will follow. The main barriers to entry include economies of scale, product differentiation, capital needs, costs of switching suppliers, access to distribution channels, cost disadvantage (regardless of scale) and the policy of the state [Porter 2010]. Economies of scale consist in reducing the unit cost of the product, together with an increase in the volume of production per unit of time. The presence of economies of scale prevents the entrance, forcing the entering party to undertake action on a large scale, which causes severe competitive response of existing firms or forces operations on a small scale.

Another way to increase the barriers to entry is product differentiation. This requires an established brand and regular customers. Diversification may include advertising, level of customer service, diversity of products, or the fact of being the first. The newly entering parties are forced in such a situation to in-

cur large expenses to overcome customer loyalty, while such investments are characterized by a high level of risk. Barriers to entry may be amplified by the policy of the state. This happens in the EU, which uses instruments to empower EU agriculture. Also the Polish government, within domestic and international law adopted by Poland (mainly the EU, WTO), can limit or prevent entry into specific industries (for example, by using the safety regulations, standards of air and water pollution, etc.).

It is worth noting that barriers to entry may change, e.g. patents expire, diversity of products in some industries diminishes, or economies of scale increase due to automation. Barriers are also affected by firms' strategic decisions, e.g. the timely introduction of new products, intense advertising, distribution expansion, vertical integration. Some companies also have the resources and capabilities that cause that the costs of overcoming the barriers to entry are lower for them. These may include, for example, developed distribution channels and the ability to share costs between greater than before number of product types.

The pressures associated with substitutable products are associated with the fact that their appearance on the market limits potential earnings and determines the price cap. The more attractive they are in terms of price and efficiency, the more they limit the gains in the sector. For example, manufacturers of sugar beet compete with producers of sugar cane or corn syrup with high fructose content. Substitution products limit profits of leaders in the market. Substitutes not only limit the possibility of raising prices, even in good times, but also profitability, especially if it turns out that the newly opened establishments have a high capacity to satisfy demand. When assessing the structural conditions of development of the agri-food sector, one must indicate substitutes for each of its branches that can play a similar role as the products of that industry. Substitution products may be from relatively remote areas of the economy.

The biggest threat are the products that can effectively replace the products of the sector because of the value for money and goods produced by sectors that achieve high returns. They contribute significantly to increases in efficiency, but also decreases in prices. Identification of such substitutes may entail a decision on strategic blockade of substitute entering the market or on adjusting the strategy, treating a particular product as an inevitable crucial force.

Very important structural conditions are the presence and strategies of local suppliers from competitive, related industries, which are the companies that perform activities complementary to the activities of enterprises of the industry (e.g. fertilizers, fuels, pesticides, agricultural machinery, etc.). The bargaining power of suppliers comes down to the fact that they can raise prices or lower the quality of goods and services. This leads to a reduction in the profitability of the

sector, which is not able to cover rising costs with higher prices. It can be said that the power of buyers is a reflection of the power of suppliers.

Suppliers of agriculture are usually dominated by a few companies, resulting in much more concentration than the sector to which they sell their products. Suppliers can have a significant impact on prices, quality and delivery terms. The group of suppliers does not have to compete with other substitution products offered to the sector; this is because there are not too many substitutes when it comes to fertilizers, fuels and pesticides. In addition, the Polish agri-food sector is not a key customer for the group of suppliers. Producers of fertilizers, fuels, pesticides and agricultural machines can successfully sell their goods to agri-food sectors in other countries and in the case of fuel producers, also to other sectors. Suppliers are then more likely to use their bargaining power.

2.2. Institutional conditions

2.2.1. Institutions that participate in the development of clusters

Clusters are associated with a number of benefits whose beneficiaries are enterprises, industries and the economy. Clusters are recognized as an innovative way to gain competitive advantage [Chrobocińska and Juchniewicz 2010]. On the other hand, Jankowska and Gorynia recognize that the dimensions in which to consider the impact of the cluster structures on the competitiveness include [Gorynia and Jankowska 2008]:

- competitive position (i.e. the resulting competitiveness, as a result of the assessment by the market of the offer of the company);
- competitive potential (i.e. resource competitiveness, the resources that the company has);
- competitive strategy (i.e. functional competitiveness, which is a set of instruments to develop a competitive advantage).

Benefits from the presence of clusters can be analyzed in microeconomic, mesoeconomic and macroeconomic terms [Kładź and Kowalski 2010]. In microeconomic terms, i.e. for companies, operation in the cluster allows for better access to information and human resources development, as well as increases the flexibility. In addition, cooperative processes are associated with the development of social capital, which is considered one of the determinants for development and maintenance of collaborative processes. In mesoeconomic terms, i.e. from the point of view of the sector, cluster structures increase the intensity of economic activity, knowledge transfer and investment, and cause the emergence of a dense network of relationships between companies of the industry and the entities representing supporting and related sectors. Total benefits that

make up the microeconomic and mesoeconomic dimension are finally reflected in the positive effects on the whole economy.

One of the characteristics of clusters are increased links between groups of entities of various types, namely businesses, government officials, scientific research units and business environment institutions. The group of institutions that support the development of clusters in Poland includes:

- ministries (special role in this respect is played by the Ministry of Economy and the Ministry of Infrastructure and Development);
- local authorities;
- national and regional agencies (including e.g. the PAED and regional development agencies);
- technology parks;
- special economic zones;
- business incubators;
- universities and associated technology transfer centres, research institutes and other R&D bodies;
- cluster initiatives;
- unions and trade associations;
- other, whose activities directly or indirectly affect the functioning of the cluster.

Those involved in the process of clustering can be ranked according to the extent of their impact. In this way, the list of entities that affect the clusters is split between levels: central, regional and local (Table 2.1).

Table 2.1. Participants in the process of creating clusters

Central level	Regional level	Local level
- regional policy - industrial policy - science policy	- regional public authorities - regional organizations	- companies - local government bodies - universities

Source: Own elaboration based on Sölvell 2009.

It can be a problematic issue to synchronize actions of individual entities, undertaken for the development of cluster structures, which would prevent duplication and blurred responsibility for its development, thus leading to the development of a coherent and transparent cluster-based policy. Institutional conditions have a significant impact on market processes, which determine competitive advantages, not only for individual companies, but also for the economy of a region or country. The measurement of competitiveness at the national level is

a multi-faceted process. In one of the most popular rankings of national competitiveness, published in the form of yearbooks by the World Economic Forum, multithreading manifests itself in the set of determinants of competitiveness, which consists of twelve pillars of competitiveness [World Economic Forum 2011]:

- basic requirements:
  - ✓ institutions,
  - ✓ infrastructure,
  - ✓ macroeconomic balance,
  - ✓ health and basic education,
- factors to improve efficiency:
  - ✓ higher education with professional development,
  - ✓ goods market efficiency,
  - ✓ labour market efficiency,
  - ✓ level of financial market development,
  - ✓ technical readiness,
  - ✓ size of the market,
- innovation and growth factors:
  - ✓ quality of the business environment,
  - ✓ innovation.

According to the WEF report of 2011/2012, leaders of the most competitive economies in the world are Switzerland, Singapore and Sweden. Among the 142 countries classified, Poland ranks 41st. The economies of countries belonging to the European Union are ranked from the third to ninetieth place. In comparison with the previous year, Poland's position has deteriorated by two places. On the other hand, in 2009/2010, Poland ranked 46th. According to the report, Poland's position is quite stable and uniform in all twelve pillars of competitiveness. Table 2.2 summarizes the results of the current (2011/2012) assessment of selected pillars of competitiveness of the EU-27.

For Poland the distinguishing characteristics include market size (20th place), reliability (16th place), and high standards in the education sector. On the other hand, one of the indicators that negatively affect the final place in the ranking is the burden imposed by regulatory authorities. At the moment Poland is considered one of the countries aspiring to become innovative economies. Achieving this status requires increased effort in relation to the pillars of innovation and the quality of the business environment. In this regard, WEF recommends strengthening existing clusters in the country, increase investment in R&D and establishing cooperation between universities and the private sector [World Economic Forum 2011].

Table 2.2. Ranking of selected pillars of competitiveness of the EU-27

Country	Rank	Pillar 1: Institutions	Pillar 5: Higher education	Pillar 12: Innovation
Sweden	3	2	2	2
Finland	4	4	1	3
Germany	6	19	7	7
Netherlands	7	10	8	12
Denmark	8	5	6	10
UK	10	15	16	13
Belgium	15	27	5	15
France	18	28	20	17
Austria	19	20	18	22
Luxembourg	23	8	40	21
Ireland	29	23	22	23
Estonia	33	29	23	30
Spain	36	49	32	39
Czech Rep.	38	84	30	33
Poland	**41**	**52**	**31**	**58**
Italy	43	88	41	43
Lithuania	44	62	26	48
Portugal	45	51	35	32
Cyprus	47	36	39	45
Hungary	48	73	45	34
Malta	51	38	37	51
Slovenia	57	55	21	40
Latvia	64	66	34	59
Slovakia	69	101	53	96
Bulgaria	74	110	70	93
Romania	77	99	55	95
Greece	90	96	46	88

Source: Own elaboration based on data from the World Economic Forum 2011.

Clusters are examples of systems where due to increased relations between the actors, access to knowledge is facilitated. This is the result of two processes. Firstly, it results from the relationship between businesses and the flow of skilled labour between them. Secondly, through a network of cooperation between the private sector and the research and development, there is a commercialization of research results, where innovation centres, which include technology transfer centres, incubators, academic business incubators and technology parks play an important role [Daszkiewicz 2008]. In addition, when schools

offer the opportunity to pursue studies in the fields of activity corresponding to the profile of the cluster, there is a flow of knowledge and experience. R&D sphere, therefore, plays a key role in shaping innovation and competitiveness.

In the case of the agri-food sector in Poland, the success factors for operating and potential clusters are undoubtedly academic institutions and R&D, which are elements of an innovative business environment. The importance of the environment increases with development of the knowledge-based economy [Kowalski 2010]. The success of efforts to develop agri-food clusters depends on the quality of services provided by these institutions. On the one hand, the issue of transfer of knowledge and strengthening the innovation in business and the economy is associated with the offer of agricultural universities in Poland. Their structure shapes future staff, which supplies human capital. In addition, the results of conducted research should be applied in the economy. On the other hand, the innovativeness of the sector is also affected by research and development units, laboratories and state research institutes, which are subject to the relevant ministries, including the Ministry of Agriculture and Rural Development.

According to Kowalski [2010], cooperation between R&D and the business sector, occurring within clusters, increases the chances for the implementation of the results of research and development in enterprises, by providing better opportunities to focus on the needs of businesses.

2.2.2. Cluster-based policy

Cluster-based policy is the result of increased interest in issues of clustering in academic circles and the desire to implement these solutions in practice. It can be considered as a new kind of regional development policy, in which the starting point is the existence of agglomeration of economic processes in relation to a specific industry and its related industries. Clusters are based on the development of a competitive and cooperative relationship, and cooperative actions relate, among others, to the relationship between the sphere of enterprises and the sphere of scientific research. A lot of emphasis in the CBP is based on the occurrence of a public-private partnership.

As defined by the Gdańsk Institute for Market Economics, cluster-based policy is "a set of activities and instruments used by the authorities at various levels to improve the level of competitiveness of the economy by encouraging the development of existing or creating new cluster systems primarily at the regional level" [Brodzicki et al. 2004].

The position of the European Union on support for clusters defines them as structures that stimulate the development of enterprises. The guidelines addressed to government authorities affecting the clustering process relate to accelera-

tion of the processes initiating or supporting the emergence of clusters and assistance for emerging relationships between entities of the cluster [Staszewska 2009].

Policy that supports the development of clusters is always accompanied by policy to promote competitiveness and innovation. According to Skawińska and Zalewski, competition policy, with which we deal at present, is multithreaded in nature. These authors emphasize that the authorities take an active role in the process of structural change, focusing their efforts, *inter alia,* on supporting micro-competitiveness. In addition, they can influence the process of FDI [Skawińska and Zalewski 2009].

From the point of view of the central and regional authorities, the impact on the clusters may be exercised directly or indirectly, in many levels of the created policy. Table 2.3 summarizes the areas of policy that affect the processes in relation to clusters.

The beginnings of support for efforts aimed at the development of clusters in the EU date back to the early 1990s. Research carried out in the framework of the Europe Innova project, for mapping of clusters, shows that in most European countries, cluster-based policy was initiated in 1990-1994 and 2000-2004 [Europe Innova 2008]. In Poland, measures to support cluster activities started in the financial perspective 2000-2006, and more specifically in 2004-2006.

Table 2.3. Implications of measures under policy focused on clusters

Policy area	Consequences
Science and innovation	Clusters whose operations are related to the results of scientific research depend on the investment in science and technological development.
Competition	Competition is a prerequisite for the occurrence of dynamic clusters.
Trade	Relationships with global markets are essential for the development of clusters.
Integration	With progressive integration, clusters have access to the resources whose flow is due to the elimination of barriers (for some clusters it is a favourable situation, for others it is not).
Regional policy	Clusters benefit from regional development programmes.
Social policy	Improving the attractiveness of clusters is done by providing access to public services of higher quality.

Source: Own elaboration based on Sölvell 2009.

Projects that have a significant impact in this area were the following [Staszewska 2009]:

- measure 2.6 IROP (Regional innovation strategies and knowledge transfer),
- measure 2.3 SOP HRD (Development of staff for modern economy),
- measure 1.3 (Creation of favourable conditions for enterprises development) and measure 1.4 SOP ICE (Strengthening of co-operation between the R&D sphere and the economy).

In the next programming period more emphasis was put on the elements that determine the operation of clusters. The importance of clustering processes in Poland may be illustrated by the fact that the strategic document "Strategy for increasing the innovativeness of the economy for 2007-2013" featured the importance of support provided to network activities undertaken by companies whose goal is the implementation of innovative projects [Kładź and Kowalski 2010].

The possibility of obtaining funding from structural funds meant that interest in cross-linking in the form of cluster initiatives in Poland increased. In the 2007-2013 perspective, financial support is delivered, among others, under the OP Innovative Economy[10]. Under Priority V (Diffusion of innovations), measure 5.1 (Support for development of supra-regional cooperative relations) is implemented by the PAED. This measure relates to joint advisory, training and investment projects of groups of entrepreneurs in the following areas: creating and managing the organizational structure of the cooperative relation (cluster initiative), preparing plans for the development of relations on the basis of cooperation, joint investments of groups of entrepreneurs and investments of cooperating entrepreneurs, which are needed for the operation and development of the relationship of marketing activities and cooperative relations [poig.parp.gov.pl]. Financing under the OPIE can be only granted to clusters and cluster initiatives of supra-regional nature. In practice, this means that the share of revenue from sales made outside the area of operation of a cluster or a cluster initiative in the total sales revenue must be at least 30% (the so-called criterion of the degree of openness to the outside). Other terms and conditions for funding under measure 5.1 include participation in cluster initiative of at least ten enterprises (of which at least half are micro- and small enterprises) and at least one research organization and business environment institution. Another criterion is to ensure equal access to project results to all members of the cooperative relation. In addition, the activity of the entity involves implementation of projects for the benefit of the members of the cooperative relation and for cooperation between the partici-

[10] For complete information about funding opportunities for cluster activities visit the portal of the Ministry of Economy www.mg.gov.pl.

pants and the scientific sphere and business environment units [Ministry of Economy 2011].

Financing under measure 5 may relate to the following projects [Ministry of Economy 2011]:

- purchase of fixed assets and intangible assets associated with the new investment;
- advisory on plans for development and expansion of relations (i.e. the cluster);
- participation in national and international meetings to share experiences;
- purchase of generally available research infrastructure (laboratory, testing);
- broadband infrastructure;
- promotion to recruit new companies to participate in the grouping;
- management of the cluster's open-access facilities;
- organization of training programmes, workshops and conferences to support knowledge sharing and networking between the members of the relationship;
- expansion of market relations.

Financing for clusters and cluster initiatives which do not meet the supra-regional condition can be provided under regional operational programmes (ROP), created in each voivodeship based on the special characteristics of the economy of the area. Another source of funding is the Human Capital Operational Programme (HCOP), which provides funding for training and consulting services to entrepreneurs under measure 2.1 (Development of staff for modern economy).

Taking into account the cluster-based policy, which leads to an effective increase of competitiveness and innovation, cluster strategies are formulated, including [Wojnicka et al. 2005]:

- the mapping of cluster structures;
- support for clusters;
- taking clusters into consideration in developed and implemented regional policies;
- support for local development and the SME sector through the use of clusters;
- use of clusters in order to attract FDI.

Cluster-based policy has not yet been separated in Poland from a number of other types of policies. The instruments designed to support clusters predominate in the trend in policy to support innovation and competitiveness. Given the short-time horizon of the presence of clusters in the Polish economic debate, one should expect to see more ways in which cluster-based policy will gain on importance.

2.2.3. Cluster initiatives in the agri-food sector

Poland belongs to the group of countries where the activities aimed at increasing the competitiveness of the economy include establishment of cluster initiatives. Their main task is to support the competitiveness of entities that form them and to obtain the benefits for the economy of the region. Polish cluster initiatives derive from a number of European examples of successful translation of cluster theory into practice. Within the framework of regional and economic policy, a number of European countries successfully implemented the theory of clusters, and the experience gained can direct Polish companies in their efforts on concluding agreements in the form of cluster initiatives.

Identification of cluster initiatives in the case of Poland is a complex and time-consuming process. Due to the lack of uniform regulations and relatively short history of institutions of this kind, in Poland there is no system of registering them, and identification often comes down to web queries. However, the results obtained with this method do not guarantee a comprehensive set of results. Cichoń and Figiel, using web queries, identified 54 cluster initiatives operating in Poland [Cichoń and Figiel, 2009]. In addition, the authors pointed to a correlation between the degree of economic development of a voivodeship and the number of active cluster initiatives. In voivodeships characterized by low levels of GDP per capita, one could observe relatively more cluster initiatives than in the most developed voivodeships. Other authors, in a study carried out one year later, compiled a list of 106 activities and projects, which to some extent were related to the generally accepted definition of the cluster initiative [Kładź and Kowalski 2010].

Formation of cluster initiatives in Poland very often takes place through entities that operate in the economy as supporting institutions and through local government units. The top-down approach, in which these institutions play a role of main actors in charge of the process of setting and operating the cluster initiative, is a systemic solution. As part of the initiatives created in the top-down approach, the companies do not initiate cooperation but become recipients of the idea of clustering. Moreover, not in all cases do they take over time a more active role in the initiative, which they form. In Poland, an important motivation to conclude agreements in the form of cluster initiatives is the opportunity to obtain financing from EU funds, allocated to cooperative activities.

The profile of Polish cluster initiatives is varied. The initiatives are focused around both the manufacturing and services. Recently, a clear trend is visible in the establishment of cluster initiatives by bodies that represent innovative activities, or representatives of the life sciences sector. This trend is not only present in Poland, but also in the European arena. Interest in actions corresponding to the nature of cluster initiatives, both in terms of research and practice,

can be considered in the case of Poland, with few exceptions, as the domain of the industrial activity.

An example of a cluster initiative which brings together companies and organizations operating in the agri-food sector in Poland is the Organic Food Valley (OFV) [www.dolinaeko.pl]. The initiative, located in voivodeships of eastern Poland (Lubelskie and Podkarpackie), is a platform for cooperation and exchange of experience in the field of organic agricultural production. The profile of the cluster initiative and its location are associated with the largest concentrations of organic farms in the analyzed area. It is estimated that the Lubelskie and Podkarpackie Voivodeships are home to 23.25% of organic producers in Poland.

The beginnings of the process of forming the Organic Food Valley go back to 2004. In 2005-2006, a project titled "Strategy of Organic Food Valley" was carried out, which resulted in the creation of the organizational concept for the emerging initiative and its programme concept. Currently, the results of the activities undertaken in the initiative include support and strengthening of cooperation taking place between producers, research institutions, local authorities and business support organizations. The OFV will gather not only entities forming cooperative relationships, but also competing operators, and thus participation in the initiative occurs simultaneously with the occurrence of typical rivalry relationships.

Currently, the cluster initiative operates under the programme "Development of Organic Food Valley Cluster", which raises funds from the European Regional Development Fund. Co-financing is done in the framework of the Operational Programme Development of Eastern Poland 2007-2013. The main objective of the project is to create a supra-regional platform (members may be entities from other voivodeships of the "eastern wall") allowing for cooperation to enable the development and promotion of organic food products. The project is aimed in particular to support the development of cluster initiatives, which will be implemented through the cooperation between the parties that form it, representing different profiles. In addition, efforts will be taken resulting in the strengthening of competitiveness and innovativeness of those involved in the cluster, the development of organic food production industry, which will be accompanied by an increase in the scale of production and the increase in demand through the use of promotional tools.

Members of the cluster include the Institute of Soil Science and Plant Cultivation - National Research Institute in Puławy (coordinator and beneficiary of the project), the EkoLubelszczyzna association and a union of associations – the Podkarpackie Chamber of Organic Agriculture. In addition to these institutions, the initiative includes several enterprises and organic farms. In spite of the

diversity of entities, resulting in a variety of relationships between members, and given the number of eco-profile players in the agri-food industry, the number of OFV members seems to be only a small fraction of the potential that could be achieved through greater participation of stakeholders.

The success of the cluster and the accompanying cluster initiative in Lubelszczyzna and Podkarpacie will depend on a number of conditions. One of the determinants of cluster development is the presence of internal demand for products or services. Building consumer awareness in organic food consumption, which results in increased demand, is the key to the development of the market. In the case of the voivodeships under consideration, there is a high potential of organic farms and organic producers, who have their operations based on experience and tradition [Skowron 2007].

Another example of the agri-food cluster initiative in Poland is the Pomerania Food Association formed in 2008. The strength of the food cluster in Pomerania, meant to be supported by the actions of the association, is demonstrated by the fact that more than 11% of industrial output in the region is from the food industry. It is understood that more than six thousand enterprises (of which more than 75% are businesses with up to 49 employees, and 85% are businesses with up to 9 employees) are engaged in food production in the region [www.smaki.pomorskie.eu].

The strategy provides for cooperation between food industry enterprises and business environment sphere, the sphere of scientific research and local authorities, seeking to improve the competitiveness of enterprises, which translates into improved socio-economic situation of the region, promoting cooperation and supporting promotion of food products from the area of Pomerania [www.smaki.pomorskie.eu].

The Pomeranian initiative that supports the development of the food cluster combines a number of entities, including enterprises of different profiles of activity (bakery and confectionery, meat processing and production of cold meats, fish processing and fishing, production of beer and alcoholic beverages, beverage and mineral water production, dairy, farms, fruit and vegetable processing, trade and distribution, and catering), supporting institutions, local authorities and research centres [www.smaki.pomorskie.eu].

In the European dimension, forming cluster initiatives is based on different legal forms of operation. The number of emerging organizations is also different. This diversity results from regional conditions, such as tradition, or the importance in economic policies of the branch that relates to supporting the cluster, as structures that determine competitiveness. The spatial distribution of cluster initiatives across Europe is diverse and reflects the spatial diversification of clusters.

A long tradition of setting cluster initiatives is present in Italy. However, it should be noted that clusters in Italy developed spontaneously, and the particular increase in specialization of production was observed in the second half of the twentieth century. Legislation governing the operation of local industrial districts was enacted in the early nineties. Support policy for *distretti industriali* is carried out in Italy especially at the regional level (by regional authorities, provincial government and municipal authorities) [Mikołajczyk et al. 2009]. According to the statement published by the European Cluster Observatory, cluster initiatives in the agri-food sector are a popular platform for cooperation between companies in Italy; there are at least a few dozen of them.

The idea of clustering in Poland is relatively young. Efforts to disseminate it among the representatives from different backgrounds and industries intensified after the accession to the European Union. In many ways, actions are often not fully consistent with the assumptions of the theory of clusters. The popularity of clustering in Poland is reflected in the establishment of a number of cluster initiatives (mostly in the form of associations), formed under the name "cluster". The problem is thus to distinguish clusters as market structures from cluster initiatives, i.e. the manifestations of institutionalized clusters. Some authors are of the opinion that the biggest obstacle to the functioning of clusters and cluster initiatives in Poland is still insufficient coordination between enterprises and scientific research units and other organizations that support them [Kładź and Kowalski 2010]. Moreover, that reluctant attitude seems to apply to all cooperative activities that may occur in any type of market relations.

3. Identification and spatial distribution of agri-food clusters

3.1. Methods for identifying and analysing clusters

Utilisation of the idea of clusters in the economic policy requires getting familiar with this idea and its practical operationalisation. Cluster characterisations are therefore defined and various typologies created. Simultaneously, identification of existing and created clusters as well as conditions for their best functioning and development are the most difficult research problems. There is no uniform methodology to identify and evaluate clusters. Many research circles establish their own methodologies for their own purposes [Staszewska 2009].

Porter thus recommends selecting competitive lines of business and sectors on an international scale in the economy of a given country. He suggests two measures: share of a given line of business in the world market and value of its indirect foreign investments [Porter 1998c]. However, application of measures suggested by Porter and others faces certain difficulties. Firstly, data are lacking in certain dimensions. Secondly, relying on statistical data may result in omitting certain lines of business and sectors. Thirdly, the limits of clusters may turn out too wide [Gorynia and Jankowska 2008]. In order to avoid errors in cluster identification, a number of alternative original ideas may be used instead of these measures. Van Dijk and Sverisson [2003] maintain that cluster establishment by enterprises is reflected by: carrying out activity in geographical vicinity, presence of numerous companies carrying out the same, similar or substitute type of activity, relations between companies resulting from subcontracting and various forms of cooperation, certain level of specialisation.

Meanwhile, Rosenfeld [1997] framed 12 questions determining the existence as well as strength of a cluster. The questions are presented in Table 3.1. On the other hand, Table 3.2 presents the list of conditions necessary and sufficient to create a cluster, set by Steinle and Schiele [2002], allowing to identify lines of business more prone to their creation. Clusters may also be analysed on various levels (Table 3.3). Consequently, the level of aggregation of phenomena allows dividing the methods for identifying and analysing clusters into methods for analysing clusters on the level of relations between the respective lines of business of the economy involved in the cluster (mesoanalysis). Certain researchers also identified the cluster microanalysis level[11].

[11] On the other hand, in the case of regional analysis the evaluation covers communities that are the most similar to one another in terms of development of economic infrastructure and investment attractiveness [Dobosz 2001].

Table 3.1. Key questions for identifying the cluster according to Rosenfeld

Aspect	Question
R&D	Is there Access to entities associated with the R&D sector in the scope of lines of business forming the cluster?
Knowledge and skills	Are knowledge and skills of the workforce adjusted to the needs of the cluster? Does the workforce have knowledge and skills of the specificity of the line of business and entrepreneurship, apart from technical knowledge?
Human resources development	Is it possible for employees to get additional training and get prepared for technological and organisational changes?
Proximity of suppliers	Are suppliers of materials and components for production located in the vicinity? What is the scale of interactions with suppliers?
Capital availability	To what extend do regional banks understand the needs of companies in the cluster and what is the availability of capital necessary to grasp market chances?
Access to specialised services	Are there public institutions acting as technology development centres, SMEs' development centres, public organisations offering support for export activities? Are there services provided by designers, lawyers, accountants?
Producers of machines and equipment	Are there companies producing machines, equipment, software used by cluster members in the vicinity? Are there good relations between machine producers and companies making up the base of the cluster with the aim to encourage improvements in both company groups?
Strength of relations	Do the companies cooperate? What is the intensity of those actions? Do the companies share resources, information? How often do they solve problems together?
Social institutions	Are there unions, trade associations in the region? How many members do they have? How active are they?

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Entrepreneurship	How many new companies are set up in the cluster? To what extent does the cluster attract new companies?
Innovations	How fast are the new technologies developed and adopted? How fast do new products, basing on those technologies, appear?
Common vision and leadership	Do the companies realise that they function as a system and have a common vision of the future and a leader?

Source: Rosenfeld 1997.

According to the microanalysis, a cluster must first be located a priori, whereas the researcher should have certain knowledge of the activity of enterprises as part of the line of business dominating in a given location. Porter presented the way to identify clusters as part of such analysis [2001], namely:

- identification of enterprises forming the cluster (large enterprise or neighbouring enterprises of the same line of business);
- following their value chains (up and down);
- horizontal review to find enterprises of similar and supporting lines of business;
- organisation of „watchers", joint entities providing enterprises with specialised skills, information, technologies, capital and material infrastructure;
- organisation of normative and legal bodies representing interests of the cluster (governmental, regional and other), able to affect the functioning of enterprises forming the cluster.

Table 3.2. Conditions necessary and sufficient to create a cluster

Conditions		Interpretation
Necessary	Divisibility of production processes	Specialisation as part of the chain/system to establish values is necessary, i.e. possibility to divide the production process into the respective phases. Fragmentation of the production process results from its technical characteristics and volume of activity of various enterprises. The activity must be extended so that several entities can compete and learn on a mutual basis at each stage.

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Necessary (cont.)	Possibility to transport the product	If transport of the product is not possible, it must be produced at the location of recipients. However, if the final product can be transported, yet production components are closely related to a specific location, suppliers of the final good are attracted to a specific location and favourable conditions are created for cluster establishment.
Sufficient	Long value creation chain	Coordination of numerous components is necessary to establish the final good – actions taken by numerous entities must be coordinated already at the stage of deliveries since deliveries are not standard but adjusted to the needs of individual customers. Various optimum production levels for the respective activities making it possible to achieve the economy of scale. Division of the value chain also results from varied profitability of its respective segments.
	Numerous, various, complementary competences	Presence of complementary knowledge within one value creation system. It's difficult for the one company to create and shape them.
	Role of innovation	If complementary skills are necessary for the innovation process, which usually means involvement of complementary enterprises in the process and time for the coordination of their activities is significant, cooperation between entities (noted for clusters) becomes the success factor.
	Market volatility	Market volatility and dynamics, i.e. lack of control of the demand side, similarly to high demand variation requiring the offer of customized products, stimulate cluster creation. Cooperative relations stimulate faster reaction to changes than hierarchical relations (which applies to companies integrated vertically).

Source: Gorynia and Jankowska 2008.

The basic technique for analyses of this type is the monographic method based on case studies. Qualitative data are obtained through direct, indirect survey or by expert method. Strong points of this method include the possibility to

obtain factual knowledge of economic activities carried out in a given location and the possibility to identify relations between entities in a given location, thus allowing drawing up of a development strategy of a given location. Meanwhile, weak points of the method include the lack of possibility to compare the results in terms of clusters with the same specialisation located in various places and subjective nature of evaluation of qualitative data. Moreover, an *a priori* assumption that a cluster with a given specialisation exists may obscure the fact of existence of a cluster formed by enterprises outside a given location [Góra 2008].

Table 3.3. Levels of cluster analysis

Level of analysis	Cluster identification	Analysis objective and method
Macro level – the whole economy	Economic objective of relations	Preparation of a national or regional model, support for innovation processes, modernisation in mega clusters.
Meso level – level of lines of business/branches of the economy	Relations within and between the lines of business to produce a common good.	SWOT analysis and benchmarking.
Micro level – level of an enterprise	Specialised suppliers concentrated on one or several leading companies.	Development of entrepreneurship, drawing up innovative projects.

Source: OECD 2001.

Porter and van der Linde in their C*luster meta study* project, carried out at Harvard University, attempted to overcome these difficulties. They collected qualitative data on 830 various clusters from 49 countries (e.g. concerning specialisation, size, geographical scale, age), and other information allowing to describe the cluster, to finally draw up a model allowing to quantify qualitative data for the purposes of comparative analysis. The model contains a collection of the following data concerning a cluster [Góra 2008]:

- basic information (e.g. type of industry, number of stages in the value chain, number of enterprises, level of employment);
- location (e.g. region, city, territorial reach);
- sources of competitive advantage (supply factors, demand factors, complementary lines of business, competition of local enterprises and their strategies, local investment conditions);
- reasons of creation (e.g. special supply factors, strategy of enterprises, competitive context);

– reasons of decline (e.g. changes in supply, loss of suppliers, lack of complementary enterprises).

Lack of possibility to define the territorial limits of a cluster is another drawback of the monographic method. A certain solution is to utilize the analytical methods used in mesoanalyses[12] of various level of complexity [Góra 2008]. One of the most widely applied methods consists in the calculation of the so-called location quotient (LQ). It consists in identifying a location in a country or region, where a given branch is overrepresented (e.g. due to the level of employment) as compared to the representation of this branch in the whole economy. Instead of employment, one may take into consideration the number of enterprises of a given branch of the economy or the volume of production. When LQ>1.25, there is in a given location a cluster of enterprises specialized in a given branch of the economy. Strong points of this method include simplicity and insignificant costs of obtaining and developing the necessary quantitative data. The fact, that enterprises of a given branch may be concentrated solely within the limits of a given country or region, is a drawback.

Gini's location quotient methods, consisting in measurement of the employment structure in a given branch of the economy as compared to the total structure of employment in the economy, provide a similar solution. A "shield" method is slightly different. It bases on measurement of the level of concentration of a given branch of the economy as compared to the likelihood of occurrence of such concentration. Changes of the quotient of concentration of a given branch of the economy as compared to employment in an enterprise with an average volume in this branch of the economy are also monitored.

In order to identify concentrations of branches of the economy mesoanalyses of clusters employ basically two categories of methods and techniques [Góra 2008]:

– these used for quantitative identification of production relations or interactions forming the innovation process;
– these used for quantitative and qualitative identification of the so-called styles of innovation.

The first category contains the method for analysing inter-branch flows (the input-output method). It is an econometric technique, which allows us to obtain full and objective image of relations based on production inputs and outputs between the branches forming the cluster. The use of this approach is considerably hindered due to the fact that the majority of countries have data on the sectoral level. Moreover, economic activity is classified differently in separate

[12] They facilitate identification of spatial concentration of enterprise groups by means of techniques to identify spatial concentrations of branches of the economy.

countries. Nevertheless, it is widely applied in cluster analyses for the purposes of the OECD (*National Innovation Systems* project) [OECD 2002].

Another method of the category in question is the innovation matrix analysis, where interactions between the entities of the cluster in the innovation process are measured. The strong point of this method is that it takes into account all types of interactions between entities of the cluster, not only inter-branch inputs--outputs. Lines and columns of the matrix are respectively suppliers and recipients of innovation and not of production. A cluster is subject to quantitative analysis as an innovative system. Drawbacks include the difficulty to obtain data, high costs of direct or indirect survey as well as difficulties to establish measures for the respective types of innovation transfers. The method is utilised by the EC as part of the *Community Innovation Survey* project [European Commission 2000].

The group of quantitative and qualitative identification of the so-called styles of innovation covers the method of suitability analysis as a quantitative and qualitative technique to identify concentrations of branches of industry of a similar style of innovation, i.e. utilisation of similar innovation transfer channels in a cluster. The analysis covers the direction and intensity of utilisation of various innovation transfer channels. Its strong point is the presentation of the image of interactions in the innovative process. The drawbacks include a difficult structure of measures utilised as well as difficulties and high costs of obtaining data [Góra 2008].

Apart from micro- and mesoanalyses there are mixed approaches. Methods are developed to analyse clusters in terms of specificity of given countries or regions or the very objective of the analysis. The analysis of statistical data available at the initial stage is usually followed by monographic methods. The examples include the method based on the analysis of relations of two types, i.e. in chains of formalised values as well as under knowledge transfers within the communication of entities of the cluster [Góra 2008].

The method consists of three main steps [Góra 2008]. The first consists in the identification of territorially concentrated value chains, using the input--output or monographic method (case studies) supported by the location quotient method. The second consists in the analysis of intensity of knowledge transfers accompanying the value chains between the enterprises and cluster infrastructure (research, educational) as well as specialist personnel. Quantitative and qualitative data are obtained from statistical data by means of direct and indirect surveys or the expert technique.

There are the following clusters as regards the flows dominating in a cluster in terms of styles of innovation:

- creating knowledge (high intensity of all types of flows);
- absorbing knowledge (dominated by flows as part of reverse integration);

– enhancing knowledge (dominated by flows as part of forward integration);
– self-sufficient in terms of knowledge (dominated by non-formalised flows between entities; formalised flows are noted for entities inside and outside the cluster).

The third step, carried out simultaneously, involves the identification of all entities affecting the innovative sphere of the cluster, thus forming a perfect model of a cluster in question as it takes into account all the possible relations. Comparison of the model with the current state makes it possible to identify the imperfections, considering the style of innovation. Strong points of this method include the establishment of a complete image of actual and potential interactions between the cluster entities, thus making it possible to draw up a development strategy and the possibility to assess cluster competitiveness in the process of its development due to monitoring of interactions of entities within and outside the cluster. Its drawbacks include subjectivity of assessment of quantitative data, difficulty to establish measures, impossibility to compare the results of analyses of clusters with the same specialisation but from different locations, difficulties to obtain data and the related high costs [Góra 2008].

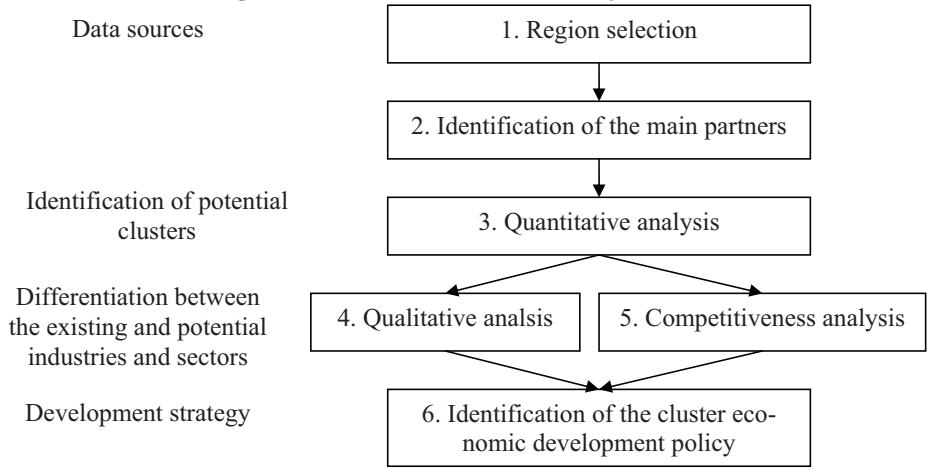
Apart from the level of analysis aggregation, the application of a given method is determined by the objective of the analysis and availability of data in practice [Góra 2008]. The majority of comprehensive analyses of clusters start with the analysis of secondary data, e.g. volume of export, employment, number of companies, making it possible to identify potential clusters, their location, reach and depth. However, universal statistics on the regional level usually fail to make it possible to perform a diagnosis of a group of companies. Therefore, micro-level information is sought after in various statistical systems [Staszewska 2009]. Questionnaire studies are often utilised. The widely used sources of secondary data include *Statistical Classification of Economic Activities* (SCEA) in the EU and *Standard Industry Classification* (SIC) in the USA. Two main obstacles related to availability of data from primary and secondary sources include time consuming nature and costliness.

In general, cluster identification therefore utilises both quantitative and qualitative methods [Skawińska and Zalewski 2009]. The first ones originate from universal statistics without information about the form and intensity of relations between entities of the cluster, in particular in terms of the institutional sphere. Meanwhile, the qualitative methods, i.e. questionnaires and surveys with entrepreneurs and experts or observations consist in subjective assessment made by respondents: factors, results, processes, obstacles, chances, etc. Mixed methods are utilised as well. They are based on multiple indicator analysis combining quantitative and qualitative aspects. The increasing number of cluster analyses

consists in the utilisation of the monographic method (case studies), complemented by statistical assessments based on primary and secondary sources.

Figure 3.1. presents the procedure to identify clusters, consisting of a sequence of six steps, the aim of which is to identify sources of data and knowledge of clusters or cluster initiatives as well as to draw up the adequate development strategies.

Figure 3.1. Procedure to identify clusters



Source: Skawińska and Zalewski 2009.

According to the procedure, the region (community, poviat, voivodeship), in which clusters on different levels of development are sought afterwards, is determined first. The selection criteria may include the type of activity, branch, group, products or technological processes. The main partners may be, on the other hand, larger and modern plants with the profile of the cluster identified, self-governmental and state institutions, associations, offices, industrial chambers and chambers of commerce, trade associations, research and development units, regional innovation agencies. The quantitative criteria most frequently utilised to identify clusters include the location quotient exceeding 1.25, average wage higher by at least 10% than the poviat, voivodeship or country average, or the growth and development rate higher than the poviat, voivodeship or country average. Potential clusters identified this way are subject to further stages of analysis making it possible to identify clusters and cluster initiatives as well as branches of industry existing in clusters or potentially interesting to them. As part of the quantitative analysis, in order to gain knowledge and data on the activity of a potential cluster, relations, flow of goods, competitiveness and cooperation relations and supporting and hindering factors, surveys with managers

should be performed on an individual basis or be focus based. Meanwhile, analysis of competitiveness of clusters should be performed on the basis of data on the number of patents, basic products, 10 main companies and regions competitive to a given cluster. Moreover, analysis of variability in time of cluster's share in these elements is recommended. In the last step of the procedure, one should determine the objectives, policy and measures on each level (local, regional, national) with key partners of the cluster. In addition, decisions regarding measures and indicators of efficiency of entities of the cluster are necessary, followed by issues of time and assessment method as well as modification of the cluster's strategy [Skawińska and Zalewski 2009].

Similar procedure in the scope of cluster mapping is recommended by Porter [1998b] and Anderson [1994]. They recommend the following stages of the procedure:

- determination of the spatial scope of the area in question by mapping the location of members of the cluster,
- analysis of employment in terms of regional concentration (concentration indicators),
- selection of probable clusters of the main entities for which mutual relations, rules of their inclusion and establishment may be identified,
- evaluation of financial settlements and addition of information from representatives of the sector and cooperating institutions (direct survey),
- graphical visualisation of branches and relations in the cluster (mapping),
- presentation of benefits and significance of the cluster for the region (tendency analysis) as well as drawing up strategic development of the cluster and the region.

In practice, various methods of comprehensive or partial nature are used to identify clusters. To sum up, the most frequent methods applied include:

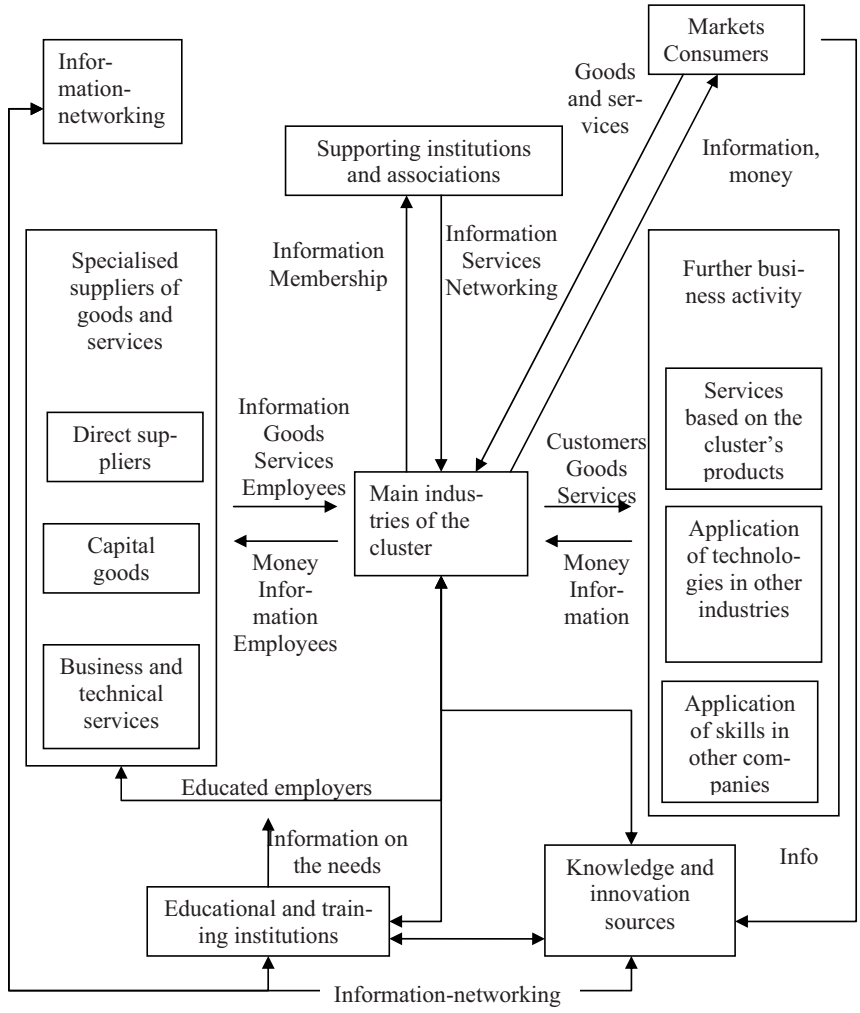
- method of penetration of relations by means of a questionnaire,
- Delphi method (expert surveys),
- analysis of inter-branch flows (input-output),
- analyses of cooperation networks in the scope of information (OECD method),
- calculation of location, concentration quotients, etc.,
- multi-sectoral qualitative analysis,
- cluster map,
- seeking leading lines/branches,
- cluster identification with GEM method consisting in the utilisation of the Porter's diamond model,
- spider web diagram.

Clusters are increasingly more often identified by means of more complicated taxonomic methods and advanced multi-variable statistics [Skawińska and Zalewski 2009]. The taxonomic methods make it possible to identify regions that are similar in terms of selected diagnostic characteristics, e.g. value, quantity, production efficiency, employment, export, sales, etc., according to the line of business. On the other hand, advanced multi-variable statistics consist in utilisation of multi dimension data for quantitative methods performed according to various algorithms. D data matrices in lines group *n* objects (e.g. branches of industrial processing according to the official public statistics system; enterprise in regional terms – community, poviat, voivodeship, region, country; territorial units – communities in a poviat or poviats in a voivodeship) described by *r* variables in columns (various qualitative and quantitative data describing economic and social aspects of activities of branches; data from inert-branch input-output flows). The most important ones include: analysis of the main components, analysis of classification and discriminatory analysis [Skawińska and Zalewski 2009].

When identifying a cluster, it is also worth developing a model of relations and links within the cluster and its vicinity. The outline of such a model is presented in fig. 3.2. When a model concerns a specific cluster, one should name each element. For instance, as far as external institutions are concerned, one should mention and evaluate strength and nature of relations with supporting institutions (self-government, state offices, agencies), business associations (general and trade organisations of entrepreneurs, industrial chambers and chambers of commerce, fairs) and non-business (scientific societies, social and cultural institutions, associations), educational (general and higher education, vocational education, guilds preparing personnel for cluster enterprises and other cooperating) as well as sources of knowledge and information (universities, scientific and research institutions, local innovative structures, including regional innovative networks and scientific and technology parks) [Skawińska, Zalewski 2009].

Apart from methods to identify clusters, there are also other methods of their analysis, namely those facilitating the forecast of their economic situation [Skawińska and Zalewski 2009]. Dittmann [2003] identified six stages of the forecasting process: formulating the task, specifying premises, determining data and ways to process them, selecting the forecast method, developing the forecast, assessing accuracy and acceptability of the forecast.

Figure 3.2. Model of relations and links within the cluster and its vicinity



Source: Skawińska and Zalewski 2009.

Clusters are analysed in numerous countries. Results of such analyses provide a source of useful information on the entities involved, relations in value chains, interactions as part of innovative relations and imperfections of innovation systems based on clusters[13] [OECD 1999]. Many cluster analyses are simi-

[13] Clusters are often treated as innovation systems examined by means of system analysis, which may relate to various entities and may be carried out on various levels (transnational, regional, sectoral, technological innovation systems and, lastly, on the cluster level). Therefore, clusters may be considered national innovation systems to a reduced scale. Their dynamics and features are therefore the same as in the case of national systems of innovation.

lar in a way they describe networks of strongly related companies or industrial groups. Relations may concern trade or innovations, may regard knowledge flows or base on common knowledge or common determinants. In all cases the starting point is the assumption that for innovation to be successful, enterprises need suppliers, customers and entities providing knowledge.

In the majority of cluster analyses several cluster analysis techniques on various aggregation levels are combined. Table 3.4. presents differences between analyses in selected countries in terms of the analysis level, technique and cluster concept applied. It turns out that in the majority of cases various techniques are combined in order to overcome the limitations of separate ones. Moreover, various methodologies may be used depending on what questions are to be answered and what information is expected as a result of the analysis [OECD 1999].

Results of cluster analyses carried out in various countries justify the usefulness of this approach in various terms [OECD 1999]. Cluster analysis is a new way of thinking about the economy and a new way of organising activities aimed at economic growth making it possible to overcome certain limitations of traditional sectoral analysis. Cluster analysis allows better presentation of the changing nature of competition and market innovation systems as well as main sources of competitive advantage. It takes into account the key, important (in terms of direction and pace of innovation) relations and dependencies in the scope of technology, skills, marketing and customer's needs between enterprises or branches of industry.

Analyses of clusters as innovation systems on a reduced scale contributed to a better understanding of innovation systems by including market imperfections and policy options. Results of those analyses have currently become basis for industrial policies. Not only do they provide analytic tools to analyse the innovation systems but may also be used as a working method when drawing up the policy in this area or as an instrument of economic growth in strategic business development, both in industrialised and developing countries.

Cluster analysis provides basis for determination of possibilities of change of the role of private sector, the government, trade organisations, educational and research institutions as well as possibilities of business development for companies of any size by crossing the limits of traditional industry. Cluster analysis provides a starting point for constructive dialogue between business and the government. The analysis allows not only to identify common problems but is also used to identify common development possibilities and to find attractive investment options for the public and private sector.

Table 3.4. Diversity of cluster analyses in selected countries

Country	Level of analysis			Cluster analysis technique					Cluster concept
	Micro	Meso	Macro	I/O	Graph	Correspondence analysis	Case study	Other	
Australia		x	x	x		x	x		Production networks, innovation networks, interaction networks
Austria		x	x			x	x	Patent data and trade	Marshallian industrial districts
Belgium	x				x			*Scientometrics*	Production networks or chains, innovation and cooperation
Canada		x	x	x			x		Innovation systems
Denmark	x	x		x	x		x		Areas of resources
Finland	x	x					x		Clusters as unique combination of companies linked together with knowledge
Germany	x	x		x		x			Identical companies and styles of innovation
Italy		x		x					Interbranch knowledge transfers
Mexico		x	x				x		Innovation systems
Netherlands		x	x	x			x		Value chains and production networks
Norway		x	x	x			x		Value chains and production networks
Spain		x		x			x		Innovation systems
Sweden		x					x		Systems of independent companies of various branches of industry
Switzerland	x	x					x	Panel data	Innovation networks
UK	x	x				x	x		Regional innovation systems
USA		x		x			x		Production chains and networks

Source: OECD 1999.

However, it should be borne in mind that comparison (both quantitative and qualitative) of results of cluster analysis carried out on various levels of innovation systems (country, region, cluster) faces numerous methodological limi-

tations and obstacles [OECD 1999]. Utilisation of existing official national and international sources of data for the purposes of cluster analysis is seriously limited by various conventions assumed in official economic activity and industry sectors classification systems. They were not designed to discover relations between various branches of industry or to facilitate the measurement of dynamics of interactions and relations between industry and enterprises. In certain countries (Canada, Denmark, Finland) a decision was made to add cluster data to national statistics by establishing statistical groups and research teams with the aim to generate data for the purposes of cluster analysis and policies based on clusters. Such activities are also planned in other countries (Belgium, the Netherlands, Sweden).

Methodological limitations also relate to the input-output (I/O) tables used for identification of clusters or technology flows. Identification of networks, as regards production, requires appropriate level of aggregation in tables. Meanwhile, cluster analyses require data of low aggregation level (3- or 4-digit codes). In certain countries (Canada, Denmark, the Netherlands, the USA) I/O tables are particularly detailed and thus very useful. Tables on the product level are similar. On the other hand, other countries (Germany, Spain) produce tables with comparatively high aggregation level (2-digit codes). There are also countries (Austria, Belgium, Sweden, Switzerland) with significant deficiencies in this regard. Consequently, data regarding the OECD countries are too aggregated in the official OECD tables to be used for comparison in the cluster analysis. In countries with possible access to accurate I/O tables one may carry out constant and useful analyses to identify production and innovation networks. Countries facing difficulties in this regard are currently attempting to improve the quality of sources of data necessary to draw up appropriate I/O tables (Belgium, Germany, Sweden).

The use of matrices of innovative relations, describing the flow of information from suppliers to users seems promising, yet they are limited solely to flows of main innovations. The basic advantage of those tables is the concentration on relations of innovations and interactions between groups throughout the innovation process. Too high level of aggregation should be considered a drawback. If questions regarding the main innovation users and procurers are not omitted in the Eurostat questionnaire that is being drawn up, accessibility of such data should be greater in the future.

Apart from statistical analysis of data, the majority of countries combine cluster analysis with qualitative analysis in form of a monographic method. The quantitative approach is necessary to map relations in the scope of production, innovation networks and economic activity clusters. On the one hand, combination to a greater extent the qualitative cluster analyses with the I/O type analysis may con-

siderably enrich the results obtained. On the other, statistically identified dynamics of clusters may be sensibly interpreted solely in combination with a more qualitative insight resulting from the monographic analysis.

International comparisons of clusters with similar specialisation face the problem of existence of several tendencies regarding changes in the country specialisation paths. As regards clusters of similar specialisation, an increasing specialisation tendency is noted in the OECD countries and in certain country groups. This results in the fact that increase of significance of networks created between different and complementary enterprises of various specialisation paths has become important international dimension of cluster analysis. Consequently, innovation systems and specialisation paths of certain clusters (functioning within the value chains producing products and services for the same target markets) in the respective countries may differ significantly as regards institutional environment and innovation level. Identification of the best practices or optimum structures of incentives as part of innovation systems becomes extremely important. International comparative studies in this area may demonstrate the key factors in shaping different strategies.

European Cluster Observatory is the main research project aimed at mapping clusters in Europe, which utilizes a rather sophisticated economic modelling based on statistical methods [European Commission 2007]. Clusters are identified on the basis of location quotients calculated on the basis of data on employment in regions, submitted via Eurostat as well as national and regional statistical databases. Data on employment are widely available and indicators are a quotient of the trade's share in total employment in a given region and the share of trade in total employment in all countries analysed. The main strong point of the project is that clusters in Europe were mapped for the first time on the basis of common statistical analyses with the use of coherent methodology applied in all the EU Member States. However, the approach still requires development and improvement. The greatest challenge is to verify whether the assumed paths of common localisation in the certain lines of business sufficiently reflect the European reality, considering the recent modernisations in technology and new models of inter-sector relations.

Boundaries between various sectors are constantly changing which may not always be reflected in the statistical data available. For example, certain clusters may not reach the threshold for the so-called 3-star cluster; though they are widely recognised as strong clusters in their sector (e.g. aviation cluster near Hamburg where the number of persons employed is not statistically large enough). In such cases it would be a good solution to combine data on employment with data on value added.

The approach applied in the project bases on measurement of identified impact (employment) of relations and the multiplier mechanism on decisions made by enterprises on location, and not on direct measurement of dynamic interactions between cluster creation drivers. A strong point of such approach is the lack of necessity to measure various interactions (e.g. input-output, knowledge creation drivers), their quantitative determination and comparison of their absolute weights in respect to the other factors affecting the decision on location, e.g. earnings or costs of transportation [European Commission 2007]. If interactions are significant, they should be reflected in current geographical models of economic activity. However, in order to better present reality and consider the establishment of knowledge-based economy, a more integrated statistical approach would be useful, covering various sources and economic data (e.g. employment and value added), technological activity (e.g. patents), scientific activity (e.g. publications). This would allow better understanding of dynamics of cluster development.

Theoretically, cluster development manifestations should be more visible if location choices made by enterprises are not affected by significant obstacles to trade and investment in various regions. Economy with the smallest possible obstacles of such nature seems the best environment for the observation of cluster development outcomes. This is the main reason for the use of American data in cluster identification. The USA have a large, integrated market. Geographical models of economic activity noted may therefore strongly depend on cluster development. Still relatively strong legacy of boundaries between the countries in Europe may be a significant force decreasing the relative significance of cluster as a location determining factor. Patterns noted in Europe are consequently the result of mixing the cluster development impact with regulations in force in the respective countries. Information about interactions between given lines of business, on the other hand, are more exposed to error. Still, there are no reasons to believe that basic technical and economic drivers in both economic areas differ significantly from one another in systematic way [European Commission 2007].

Despite strong conceptual premises favouring the use of American data as the main source of information in setting out cluster identification criteria, it is worth using the European data as well. Both areas have lines of business with significantly different structures, which should be reflected in cluster structures. Unfortunately, European data are considerably weaker than American data in qualitative terms, what limits the possibilities of their use for the purposes of cluster analyses. The main methodological challenges in Europe include [European Commission 2007]:

– availability of data on NUTS 2 level defined on the basis of administrative borders;

– insufficient level of detail of the NACE system data;
– level of employment as the only parameter fully available for all regions and lines of business.

The regional NUTS 2 level of data is defined on the basis of administrative borders which may not fully reflect economic interactions. NUTS 2 regions differ geographically and in terms of size of the population. Certain NUTS 2 regions are the whole countries, e.g. Denmark, with national authorities, while others are regions inside the countries with local authorities. NUTS 3 and higher level data are generally not available. In the USA, economic areas have been defined at the uniform national level on the basis of economic relations, in particular the sense of community.

Meanwhile, four digit classes in the NACE system providing European data are not sufficiently detailed to cross the boundaries of traditional sectors and to be able to reflect full abundance of cluster as groups of economic activities of various sector entities. On this level, even the best grouping of lines of business with cluster results fails to provide an adequate view of the situation in cluster categories that are similar to traditional trade groupings. This makes it impossible to reflect the mixture of services and production functions, which is typical of cluster structures. By comparison, in the USA the five and six digit NAICS classifications available make it possible to perform more refined analyses of cluster relations between various lines of business. As regards the level of detail of analysis, it is significant that in Europe employment is the only fully available parameter for all regions and lines of business. In the USA, information on earnings and patents are available as well, which makes it possible to carry out in-depth analyses of the impact of clusters on the level of innovation and competitiveness.

It should be borne in mind that despite increased level of granularity the American data are not perfect either. Overview of the NAICS classification system contributed to the increase of the level of detail of data in respect of the IT and services sector. However, there is still insufficient variation of numerous business services and activities related to education, which are not only significant of clusters but also play an increasingly important role in modern economy. Consequently, clusters identified turn out to be too much focused on production or services, while large cluster structures in the areas of business, educational services or knowledge creation remain unidentified. Another limitation is that the current classification systems, e.g. NAICS, NACE, fail to reflect sufficiently the occurrence of new lines of business, e.g. biotechnology. Lack of basic statistical data in this regard effectively hinders identification of more refined cluster structures.

Reservations regarding the nature and usefulness of data available in Europe and general weakness of classification systems should be recognised with due gravity [European Commission 2007]. However, even with their current quality, data may establish basis for analyses providing significant contribution to the European political debate. In particular, they make it possible to demonstrate the level of regional specialisation in European regions as compared to American ones and may be a source of knowledge regarding relations between economic results and cluster strength. In addition, they may provide basis for regular comparisons of strong clusters with given specialisation in various regions of Europe. Even though data collected by *European Cluster Observator*y fail to make it possible to provide ultimate answers, they allow establishing a new view of the economic reality by providing sufficient basis for taking further political decisions.

Subsequent types of data are collected and analysed. Results of the project are compared with other available statistical analyses in order to increase their credibility, e.g. *Regional Innovation Scoreboard*. In order to confirm the results of statistical analyses and to obtain complementary information, which could not be presented in form of statistical data (e.g. institutional environment conditions), the project is complemented with case studies. They form a source of qualitative data regarding success factors in cluster development. They are collected through interviews with representatives of economic policy circles and cluster members as well as through analyses of cluster at the stage of growth and decline. Particular attention is paid to transnational cluster. All the EU Member States are analysed, as well as the associated countries [European Commission 2007].

In Poland, the majority of cluster analyses carried out are not as methodologically advanced as e.g. I/O type analyses or data clustering. Questionnaire studies are quite popular as well as concentration indicator calculation and graphical method of cluster presentation [Staszewska 2009]. Within the last few years cluster analyses have been carried out on the national and regional level in Poland (Mazovia, Opolskie region, Silesia, Pomerania). They provided significant input in regional development strategies. Furthermore, an international group of researchers was ordered by the EC to carry out the analysis of clusters in Central and Eastern Europe (CEEC) as part of the *EU Cluster Observatory* project [Ketels and Sölvell 2006].

Comprehensive cluster analyses in Poland were carried out by researchers of the Faculty of Economics, University of Gdańsk and Gdańsk Institute for Market Economics. They prepared cluster mapping as part of the *Cluster Mapping Project* (CMP) [Szultka 2004]. A three year project was finished in 2012. Its aim was to identify industry clusters in Poland, to assess their economic effects as well as implications for the regional development policy. The Institute's

CMP project involved carrying out qualitative and quantitative analyses [Brodzicki 2010]. The first module was based on British methodology developed by DTI. Employment data from the 3-digit NACE classification were used in sectoral dimension as well as from the level of poviats and communities in spatial dimension. The data panel was from the year 2001.

The first step was to identify employment concentration on the level of poviats and communities. Clusters were defined as groups of 3-digit NACE sectors combined horizontally or vertically. Analysis of collocations of activities and relations in I/O tables was carried out. 20 clusters were identified this way. Areas of significant concentration were defined by means of LQ, taking into account employment and assuming arbitrarily that the indicator above 1.25 was to signify the existence of a cluster (employment concentration on the level of at least 25% over the national average).

The second step took into account the concentration indicator in key sectors and depth of a given cluster (considerable concentration in majority or in a given branch of the cluster) and identified areas where clusters presented on a map were most likely to exist. The third step involved the selection of locations where clusters were most likely to exist in nine traditional and non-traditional branches taken into account. In order to identify characteristics of clusters (e.g. depth and reach of relations between enterprises and research and development sector, innovativeness, effectiveness, existence of the so-called cluster initiatives, employee mobility) qualitative analyses were carried out as well as extensive interview with randomly selected potential members of the cluster.

Basing on the results of the analysis it was found that location of enterprises within the identified cluster structures has positive impact on their activity outputs and competitive potential, thus being able to stimulate economic growth. The methodology applied made it possible to analyse the collocation paths and I/O relations in the economy, to carry out analysis on spatial level of aggregation to identify inter-regional cluster and combination of quantitative and qualitative analysis. Weaknesses of results of these analyses include relatively wide definition of clusters, failing to take into account spatial autocorrelation at initial stages, incomplete consideration of the problem of false correlation, lack of clear definition of the geographical dimension of the cluster, subjectively assumed threshold for LQ on the level of 1.25, relatively small number of interviews per a potential cluster (statistical significance of results) and failing to take into account the number and size of enterprises within the areas of considerable concentration [Brodzicki 2010].

Statistical analysis on the regional level [Ketels and Sölvell 2006] was ordered by the EC and carried out to analyse clusters in new EU Member States. Cluster categories were based on Porter, who identified three different lines of

business: evenly distributed lines of business providing services to local markets, lines of business spatially concentrated and lines of business whose location is linked to the presence of specific resources and natural features [Porter 2003]. It is important that Porter maintains that a given line of business may belong to numerous clusters. However, researchers failed to take into account the fact that European market, as opposed to American market, was integrated only recently and certain obstacles inside the EU still pose problems. They claim that cluster definition used in the USA and based on location models better reflected the strength of relations between lines of business. However, its adaptation involved an assumption of homogeneity of technology and lack of differences between regions as far as natural resources are concerned.

Economies of the CEEC countries in question, despite notable progress, are still far behind the American technological dominance. As compared to markets of developed economies, their markets are weaker regarding the number of enterprises, product variation, strategic relations, market strength distribution, competition type and intensity or the level of disruptions resulting from weaknesses of institutions. Development of clusters in the CEEC countries is hindered also due to numerous "soft" obstacles, e.g. decreased social capital in the communist period (lack of trust).

Finally, cluster classification according to Porter (cluster categories) was subject to certain modifications. American SIC classification had to be translated (not without problems) into European NACE classification. NUTS 2 areas became analysed regions and employment data were collected on the level of 4-digit NACE codes. As regards Poland, CSO employment data of 2001 were used. The main problem was that with greater disaggregation numerous data were lost on account of their confidentiality. Identified clusters were classified and divided in terms of size (15 thousand of employees), specialisation (1.75) and domination (share in regional employment above 7%). Selection of such threshold values may be questioned in the methodological dimension. Identified clusters meeting the above mentioned criteria were given stars, one for each criteria, after which they were ordered according to the sum of stars obtained (three-star system).

The results were verified by comparing them to data on the national level regarding export of food typical for a cluster and regarding macroeconomic competitiveness of business, as well as by discussing them with representatives of authorities from the national and regional level. Unfortunately, they turned out not very revealing in the context of conclusions drawn [Brodzicki 2010]. They confirmed what has been universally known. It might have resulted from the selection of the spatial aggregation level. The other drawbacks of the analysis include: failing to take into account spatial autocorrelation and the number

and size of enterprises in agglomerations analysed, failing to take into account in the analysis inter-regional clusters and weak confirmation as a result of qualitative analysis. However, the strong points of the analysis include the assumed, relatively clear cluster definition by Porter, use of a coherent methodology in respect of the group of 10 new EU MSs and creating possibilities for comparisons between regions of various MSs inside the EU.

To sum up, it should be added that numerous specific conclusions were drawn from the analysis of Polish clusters [Brodzicki 2010]. Methodology applied must be adjusted to the greatest possible extent to specificity of the region in question. When elaborating a clear and precise cluster definition one should take into account e.g. the level of technological development of the economy in question (scopes and types of relations in large, well integrated economy and in small, relatively backward economy in transition period vary). Cluster categories defined by Porter should be verified in terms of economic specificity of a given country. Moreover, if data allow, the analysis should be carried out on the best possible level of sectoral and spatial disaggregation. Sectors with at least 3-digit category of NACE classification, on the level of communities or poviats, turn out the best for Poland. Voivodeships from the NUTS 2 level turn out too large. At the beginning one should also take into account the possibility of autocorrelation of spatial data. As far as identification of areas with concentration indicators above the average is concerned, methods used for the calculation of market potential should be utilised. Special attention should be paid to the impact of the threshold values.

Apart from employment data, in the analysis should be included at least data regarding the number of enterprises divided by sectors as well as the information about their distribution on account of the employment rate within a given sector. As regards economies in transitional period, greater number of periods should also be analysed. Firstly, each year has its specificity. Secondly, transition takes place relatively fast. Also, accession to the EU had substantial impact, which should be taken into account in the future. However, going outside the regional analysis seems the greatest challenge. Regional direction is not the cluster's characteristic and inter-regional clusters exist and may be significant also for regional development policies.

It should also be borne in mind that mapping should consist of two important stages:

- quantitative analysis facilitating the identification of important agglomerations of interrelated lines of business;
- quantitative analysis of strength and scope of relations as part of these agglomerations.

Therefore, only after adequate identification and analysis of cluster it is recommended to implement the cluster policy. Without adequate cluster analyses the sense of such a policy may turn out very doubtful.

Identification of members of national cluster programmes may pose another research problem. In this context, one should define target groups, member identification methods and the selection mechanism [OECD 2007]. The selection of target groups, e.g. places (leaders, less developed areas, main centres), sectors (dynamic, of strategic significance, of social significance, at risk) and specific actors or actor groups (universities, all small companies, foreign companies and investors, consortia of various entities) or certain combination of the above mentioned elements, depends on economic grounds of public intervention. Target groups must be clearly specified (identified) in order to ensure the suitability of resources available and attainability of objectives. The choice of the selection mechanism must be coherent with objectives of the programme. Table 3.5 presents various types of target groups and selection mechanisms assumed for the purposes of implementation of selected cluster programmes in selected countries.

When selecting a target group at the beginning, one should make a fundamental decision on economic areas that are key for the programme, e.g. by targeting the less developed as in the case of European structural funds, or completely abandon the identification of areas. Another step is to select dynamic sectors and those at risk or to open programmes to all sectors. Certain programmes focus solely on the most developed sectors or characteristic to an extent (e.g. strategic sectors, high growth sectors). Other potential target sectors include those which face difficulties or are more at risk of international competition.

Certain programmes may focus on sectors of great social significance. There is also a debate in certain countries whether such programmes should cover small or large enterprises. If there is no specification, programmes must serve both of those groups, though they differ in terms of needs. Generally, selection of a target group is determined by political objectives and the planned spatial scope of their implementation. It may be a formal choice or the one based on the structure and instruments of programmes. In the selection process, clear definition of the problem in question may be very helpful. For example, higher economic growth is a too general objective. The level of GDP per capital may increase, if sectors of high value added are selected, though employment does not necessarily have to increase.

Table 3.5. Target groups and selection mechanisms in selected countries

Country	Programme/policy	Reach	Target regions	Target sectors	Selection mechanism	Competitive?	Number of selected (submitted) projects
Canada	NRC, *Technology Cluster Initiatives*	National	All regions	Technologies in high technology industry and other	Dialogue	No	No data
Czech Republic	Clusters	National (except for Prague)	Less developed regions	All, numerous restructured	Individual application, certain groups encouraged to participate	Collection of applications until exhaustion of funds	All qualified applications selected
Finland	*Centres of Expertise*	Regional	Regional urbanisation centres (preliminarily main cities)	Key (innovative potential, even with lack of high technology)	Independent application	Yes	22 (no data)
	National Cluster programme	National	No targeting at specific regions	The largest sectors of the economy	Mapping results and relation with sectoral ministers	No	No data
France	*Poles de competitive*	National (international clusters); regional (regional clusters)	Key (international clusters); all regions (regional clusters)	Key sectors (international clusters); all sectors (regional clusters)	Independent application	Yes, multi-level	67 (105)
	Local Production Systems (SPL)	Regional	All regions (often not key ones)	All sectors concentrated in industrial districts SMEs	Independent application	Yes	No data

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Germany	*BioRegio*	National	Key	Biotechnology	Independent application, with land support	Yes	4 (17) obtained the majority of funds
	InnoRegio	Regional	Less developed (eastern lands)	Sectors with the potential to grow	Independent application	Yes	25 (400)
	GA-network initiative	National and regional	Less developed lands	All	Identification by lands in the context of more extensive regional development strategy	No	No data
Italy	LAW 317 (91)	Regional	All	Decision on the level of regions	Mapping based on statistical data	No	No data
	Technological Districts	National	All regions (plus special component for the south of Italy)	Strategic areas in national policy on science and technology	Strategic mapping	No	11
Japan	MEXT *Knowledge Clusters*	National	Key university areas	High technologies	Identification by ministries in communication with universities	No	18
	METI *Industrial Clusters*	National	All regions (determined needs of various region categories)	Key	Regional METI officers identify promising cluster projects to be considered	No	19
Korea	*Innovative Cluster Cities*	Regional	All regions (except for Seoul), on the basis of existing industrial infrastructure	National strategic lines of business	Strategic selection criteria	No	7 (selection for piloting, should cover all of more than 30 complexes)

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Netherlands	*Peaks In the Delta*	Regional	Regions stimulating economic growth on the national scale	The largest sectors in the regional economy of national significance	Analysis by the Regional Programming Commission	No	No data
	Key Innovation Arena	National	Lack of clear regional preferences but with regional impact	Key (innovative and growth potential)	Analysis by the Innovation Platform Council	No	No data
Norway	*Arana Programme*	Regional	All regions	All (sectoral neutrality)	Independent application and dialogue	No	No data
	Centrem of Expertise (NCE)	National and regional	All regions	All (sectoral neutrality, important research and development)	Independent application	Yes	No data
Spain, Basque Country	*Competitiveness clusters*	Regional	All subregions	Important sectors of the economy: numerous restructured	After mapping and public-private dialogue the branches may apply; preliminary selection; clusters file petitions to the government	No	Approval of candidates who applied and have qualified
Sweden	VINNVAXT	National	Key	Key (high growth)	Independent application	Yes	1 round: 3 full and 7 partial recipients (25 selected from among 150 receive grants)
	Visanu	Regional	All	Priority in regional development plans	Preliminarily identified in the regional growth plan; selection by means of dialogue	No	30 (obtain process support)

continued on p. 90

Sweden (cont.)	*Regional Cluster Programme*	Regional	All	Priority in regional development plans	Preliminarily identified in the regional growth plan; selection by means of dialogue	No	1 round – selection: 3 projects, 7 submitted applications receive basic support
UK	DTI/RDA/DA	National	All	Priority clusters defined by the region in regional economic strategy	Regions organise mapping and similar studies (guidelines and support are provided by DTI)	No	No data
USA, Georgia	*Georgia Research Alliance*	Within the area of the state	All subregions with partner universities	High technologies	Non-governmental sector or sectoral/university experts select projects of potentially largest positive impact on the state	Yes	Depending on projects
USA, Oregon	*Oregon Cluster Industries*	Within the area of the state	All subregions	The largest sectors in the economy, potential to increase employment	Identification through mapping	No	No data
	Oregon Cluster Network	Within the area of the state	All subregions	All	Independent application by a member	No	All approved

Source: OECD 2007.

Numerous potential tensions are involved in the selection of each group. They should be considered first. Identification of potential members of cluster programmes is also a challenge in itself due to difficulty with quantitative determination of cluster existence and activity. Differences between results of analyses carried out not only result from various identification methods, but also reflect various perspectives of perceiving the problem and directions of policy assumed. Observations allow identifying three strategies for identification of entities participating in cluster programmes' implementation: quantitative identification, relying on the lower governmental level and independent proposal [OECD 2007].

There are two basic approaches to cluster mapping as part of quantitative identification, i.e. focusing solely on concentration in the sector of industry or combining concentration and interrelations. This strategy is more readily used in programmes concerning science and technology. Its aim is to identify the statistically greatest clusters, i.e. which provide the greatest input to the economy or to sectors related to trade. Detailed analyses of competitiveness are carried out in certain studies in order to determine whether and to what extent the greatest clusters have the potential in the context of the whole economy and the respective sectors.

Cluster mapping with statistical methods identifies collocation. Meanwhile, actual relations between entities are confirmed by subsequent analyses. Such information is necessary to develop instruments most adjusted to cluster needs. Several national programmes were started with quantitative mapping and then extended. For example, 40 additional in-depth mapping analyses were carried out in the Czech Republic. More detailed analyses often form part of the first phase of the cluster developing programme. Results of analyses of this type in Sweden, complemented with information from other sources, were taken into account by certain Swedish agencies when elaborating cluster identification programmes. Similarly in Great Britain, in order to better understand cluster relations several programmes of this kind were launched.

Identification of targets of cluster programmes elaborated as part of the national policy is often obtained by delegating responsibility in this regard to a lower level or to dispersed agencies of the central government. Such a strategy increases coherence of decisions made on various levels. It is utilised in such countries as Sweden, Germany, Japan and Great Britain. In Great Britain, for example, DTI provides guidelines but regions identify priority sectors or clusters and determine levels of support and types of instruments as part of their regional economic strategies approved by DTI.

Meanwhile, a statistical model with clearly specified and detailed criteria, which makes it possible to determine which industrial districts may be supported as clusters, was elaborated in Italy. Its criteria base on the concentration level as

regards employment and the number of enterprises in a given line of business within a specific area. The model may be utilised for the needs of any region, in order to find industrial districts, which qualify for support with various SMEs assistance instruments. As decentralisation has developed the respective regions in Italy achieved greater independence as regards support for enterprises. Therefore, individual formulas or ones approved by the central government are used for cluster selection on the regional level.

Numerous programmes base on self-identification of clusters. It is a bottom-up approach. In the majority of cases the group of potential members is limited by specific availability criteria, which may relate to the number and type of entities desired in the cluster (including regional public support), location and scope of projects and cooperation, which may be financed. Lack of awareness of the possibility of self-identification, e.g. through request for a proposal, is the greatest problem.

The next step, after selection of target groups and member identification method, is to choose an appropriate selection method. The selection mechanisms utilised take into account the competitive procedures (based on open competition or invitation to submit tenders) as well as non-competitive ones (recipients are predetermined). The first are used for the purposes of identification of the strongest projects as part of a given target group and for measuring motivation of key entities, in particular the private sector. The selection may be top-down and bottom-up.

In general, there are strategic conditions for the use of various mechanisms. They depend on e.g. programme objectives, knowledge of the policy-maker regarding the quality of potential members as well as ambitions to use additional funds. In various selection mechanisms there are different transaction costs, which may be compared to benefits. Credibility of the selection mechanism and the number of selected members also affects considerably the labelling effect, which is the objective of numerous programmes. Table 3.6 conditions for the use of various selection mechanisms.

Table 3.6. Conditions for the use of various selection mechanisms

Mechanism	Conditions
Competitive	- when the best members are not visible at the beginning - member motivation assessment - significance of labelling - long-term spillover for not selected groups
Limited number	- clear determination of priorities regarding resources - significance of labelling
Top-down	- clear objectives (strategic, quantitatively indefinable) - coherence with other programmes
Bottom-up	- when the best or possible members are not visible at the beginning - the best way of identification is self-identification - member motivation assessment
Mixed	- the best choice in the predefined area - the lowest governmental level is the most suitable for selection purposes - required cooperation of all governmental levels - special additional deliberations during selection

Source: OECD 2007.

3.2. Cluster mapping in the European space

Identification of clusters in the economic area is a complicated process. Different approaches may be applied, depending on the type and availability of data. As indicated above, the most widely used methods facilitating comprehensive identification of cluster structures are based on employment data. In the case of the majority of European countries, including the EU MSs, data comparability is easier due to unification of used classifications of economic activity. However, their availability is a problem, in particular when employment data on more detailed levels of economic classifications have to be used.

The *European Cluster Observatory* is a valuable source of statistical data enabling the identification of clusters in the European area. The *Observatory* elaborates and makes available for information and scientific purposes data that facilitates cluster mapping. Simultaneously, it promotes the idea of economic growth based on clusters within the Old Continent. Based on the developed methodology of cluster identification on the basis of the NUTS territorial classi-

fication and 615 classes of economic activity (NACE classification), the *European Cluster Observatory* identified 41 types of standard clusters, 8 creative clusters, 4 KIBS clusters (knowledge-intensive business services) and 3 types of life-science clusters [www.clusterobservatory.eu]. The agri-food sector clusters are among the standard clusters, i.e.: agricultural products clusters, farming and animal husbandry clusters and processed food clusters.

To identify and assess the strength of the forces of agglomeration of clusters three dimensions are taken into account: their size, specialisation and focus. Clusters which undergo positive verification of each of the above dimensions are considered the strongest (each of the features is awarded one star). Assessment of the first dimension – size – refers to the statement whether employment in a given cluster category in the analysed NUTS 2 area is high enough to be included in the 10% of the largest clusters of that kind in the group of countries in question. Another feature – specialisation – is based on the location quotient (LQ). The quotient is a relative measure and provides comparison of share of employment in a given cluster category in total employment for a given region as compared to identical proportion corresponding to a larger reference area (in this case – Europe). Pursuant to the assumptions of the *European Cluster Observatory* the strongest clusters include those structures for which the LQ has the value exceeding 2.

Considering focus as the third dimension in question, clusters are identified as the strongest when their share in employment in the region facilitates their inclusion in the group of the 10% largest clusters in that region. Table 3.7 presents the list covering 28 European countries (the EU MSs and Iceland) detailing the number of clusters meeting all or some of the criteria used to identify the strongest clusters in Europe. Countries with the largest number of clusters with three stars include: Germany (30 clusters), Great Britain (17 clusters) and – surprisingly – Romania (14 clusters) and Bulgaria (13 clusters).

In the case of Poland, clusters assessed as the strongest are located in the following voivodeships: Wielkopolskie (3 clusters), Łódzkie (2 clusters), Mazowieckie (2 clusters), Śląskie (2 clusters) and Warmińsko-Mazurskie (1 cluster) [www.clusterobservatory.eu].

Table 3.7. Relative strength of clusters in selected European countries

Country	Cluster strength			Country	Cluster strength		
	★★★	★★	★		★★★	★★	★
AT	4	27	56	IS	1	0	4
BE	3	12	50	IT	11	96	127
BG	13	16	19	LT	2	5	2
CY	0	1	3	LU	0	2	2
CZ	6	24	39	LV	0	2	4
DE	30	94	190	MT	0	4	5
DK	0	3	27	NL	0	22	61
EE	0	1	8	PL	10	49	103
ES	11	41	99	PT	7	21	20
FI	2	9	23	RO	14	40	38
FR	6	35	124	SE	5	10	50
GR	6	27	47	SI	1	6	9
HU	2	12	45	SK	2	18	25
IE	1	5	4	UK	17	46	119

Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

Analysis of specialisation in respect of the three types of agri-food clusters in Europe reveals that there is high variation of the location quotient between countries (Table 3.8). The highest level of specialisation in the agricultural products category was noted in Bulgaria (LQ=7.02), Romania has the highest quotient for farming and animal husbandry (LQ=5.55), whereas Poland in terms of processed food (LQ=2.11).

Agricultural products clusters are identified by summing the employment in the following economic activity classes according to NACE 2.0: 01.61, 01.62, 01.63, 01.64, 10.41, 10.81, 11.01, 11.02, 11.03, 11.04 and 81.30. Farming and animal husbandry falls within the following classes: 01.11, 01.13, 01.24, 01.25, 01.30, 01.41, 01.42, 01.45, 01.46, 01.47, 01.49 and 77.31. Processed food clusters fall within the following classes: 10.11, 10.12, 10.13, 10.31, 10.32, 10.39, 10.51, 10.52, 10.61, 10.62, 10.71, 10.72, 10.73, 10.82, 10.83, 10.84, 10.85, 10.86, 10.89, 10.91, 10.92, 11.05, 11.06, 23.13, 23.19, 25.91, 25.92, 28.93, 46.11, 46.21 and 46.23 [www.clusterobservatory.eu]. Figure 3.3 presents the division of agricultural products clusters in the selected European Union MSs according to the level of their specialisation, rate of employment (circle diameter) and GDP level *per capita* (PPP) in 2007[14].

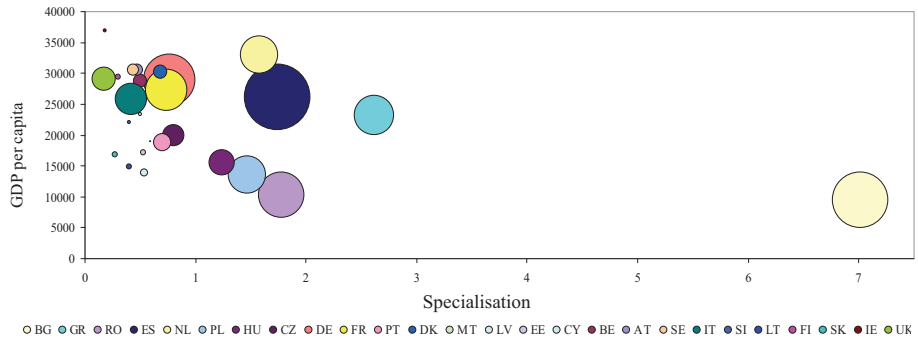
[14] In order to obtain clarity of elaboration, vertical scales on charts presenting spatial specialisation in the scope of agri-food clusters have been limited to the level of EUR 40,000, which results in omitting data representing Luxembourg in those charts.

Table 3.8. Indicators of specialisation of agri-food clusters in the selected European countries

Country	Cluster		
	Agricultural products	Farming and animal husbandry	Processed food
AT	0.47	0.02	1.38
BE	0.5	0.35	1.01
BG	7.02	4.87	1.22
CY	0.5	1.67	0.98
CZ	0.8	0.88	1.17
DE	0.77	0.38	0.93
DK	0.68	1.02	1.04
EE	0.53	0.01	1.17
ES	1.74	1.78	0.73
FI	0.3	2.15	0.84
FR	0.74	0.54	1.16
GR	2.62	3.73	1.07
HU	1.24	1.66	1.42
IE	0.18	0.02	1.53
IS	0.47	1.93	1.14
IT	0.42	0	1.08
LT	0.4	0	1.95
LU	0.19	0.02	0.75
LV	0.54	0.7	0.95
MT	0.59	0.01	1.18
NL	1.58	1.42	0.76
PL	1.47	0.3	2.11
PT	0.7	0.03	1.05
RO	1.78	5.55	0.94
SE	0.44	0.62	0.85
SI	0.4	0	1.46
SK	0.27	0	1.34
UK	0.17	0.07	0.62

Source: European Cluster Observatory, 15.10.2011.

Figure 3.3. Agricultural products clusters in selected EU MSs



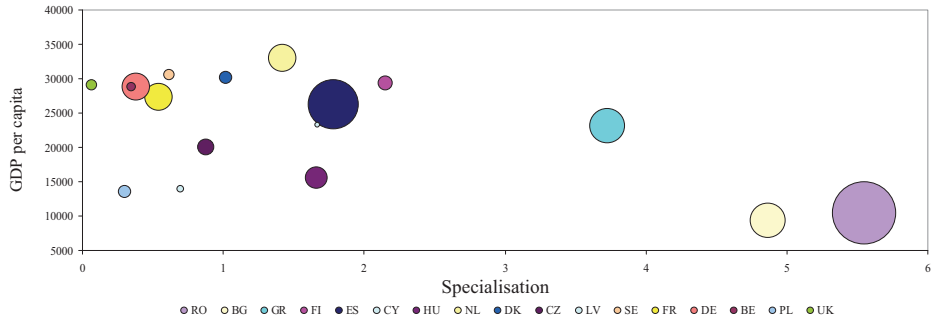
Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

According to the adopted methodology, only two countries, i.e. Bulgaria and Greece, have their location quotients above 2. As far as the absolute number of employees is concerned, the smallest agricultural products clusters simultaneously have one of the lowest location quotient values.

In the case of farming and animal husbandry clusters, the level of specialisation in the European Union MSs varies more than for agricultural products clusters. Moreover, in several cases the location quotient assumes the value of 0, which is the reason why the list presented does not contain data for certain EU MSs (Figure 3.4). The value of the location quotient in the group of 17 countries in question ranges from 0.07 (Great Britain) to 5.55 (Romania). The Polish farming and animal husbandry cluster occupies the 16th place in the ranking.

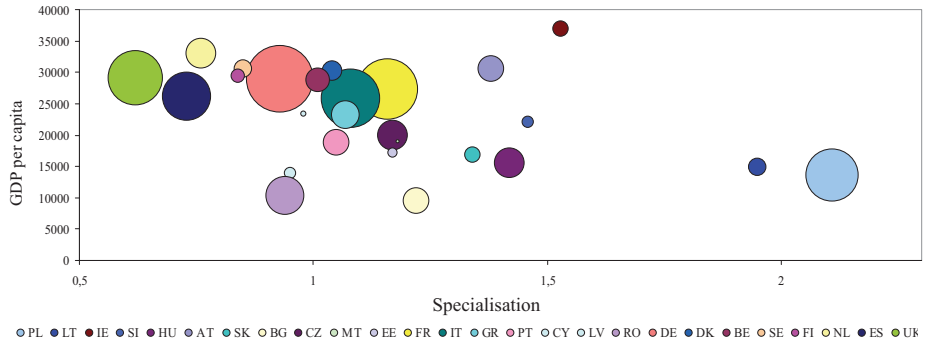
Processed food clusters in the EU represent the highest employment rate among the three identified categories of agri-food clusters and their average share in the 27 economies of the EU is at 72% (Figure 3.5). The value of the location quotient for this cluster category ranged from 0.62 (Great Britain) to 2.11 (Poland). It should be noted that data published by the *European Cluster Observatory* that formed basis of cluster mapping, originated from national statistical offices and was in the majority of cases related to the year 2008.

Figure 3.4. Farming and animal husbandry clusters in selected EU MSs



Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

Figure 3.5. Processed food clusters in selected EU MSs



Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

The *European Cluster Observatory* also makes available more detailed data allowing to draw up a list of clusters in NUTS 2 regions. Tables 3.9-3.16 present rankings of 10 regions with the highest values of location quotient in the scope of selected groups from the NACE Rev. 1.1 classification of economic activity, representing the agri-food sector.

Table 3.9. Ranking of clusters according to NACE Rev. 1.1, group 01.1: Growing of crops; market gardening; horticulture

No.	Region	Specialisation indicator	Employment
1	Severozapaden (BG)	27.45	77,578
2	Severoiztochen (BG)	21.21	153,550
3	Yuzhen tsentralen (BG)	20	221,716
4	Peloponnisos (GR)	19.18	69,562
5	Yugoiztochen (BG)	18.35	75,434
6	Severen tsentralen (BG)	17	111,903
7	Anatoliki Makedonia (GR)	12.71	41,861
8	Thessalia (GR)	12.68	52,425
9	Kriti (GR)	11	39,638
10	Dytiki Ellada (GR)	10.85	42,122

Source: European Cluster Observatory, 15.10.2011.

Table 3.10. Ranking of clusters according to NACE Rev. 1.1, group 01.2: Farming of animals

No.	Region	Specialisation indicator	Employment
1	Nord-Est (RO)	23.95	192,869
2	Sud-Muntenia (RO)	13.23	88,109
3	Ipeiros (GR)	9.66	5,923
4	Centru (RO)	8.84	40,783
5	Anatoliki Makedonia (GR)	8.68	9,428
6	Friesland (NL)	5.93	7,909
7	Dytiki Makedonia (GR)	5.27	2,621
8	Thessalia (GR)	5.23	7,132
9	Nord-Vest (RO)	5.18	27,125
10	Del-Alfold (HU)	4.28	9,808

Source: European Cluster Observatory, 15.10.2011.

Table 3.11. Ranking of clusters according to NACE Rev. 1.1, group 01.3: Growing of crops combined with farming of animals (mixed farming)

No.	Region	Specialisation indicator	Employment
1	Sud-Vest Oltenia (RO)	25.99	468,156
2	Nord-Est (RO)	20.45	586,564
3	Sud-Est (RO)	15.02	296,515
4	Sud-Muntenia (RO)	13.05	309,679
5	Nord-Vest (RO)	11.79	219,946
6	Vest (RO)	9.79	131,387
7	Centru (RO)	6.21	102,058
8	Ipeiros (GR)	3.79	8,278
9	Dytiki Ellada (GR)	2.47	11,251
10	Jihovychod (CZ)	2.2	27,472

Source: European Cluster Observatory, 15.10.2011.

Table 3.12. Ranking of clusters according to NACE Rev. 1.1, group 01.4: Agricultural and animal husbandry service activities, except veterinary activities; landscape gardening

No.	Region	Specialisation indicator	Employment
1	Warminsko-Mazurskie (PL)	3.38	2,166
2	Wielkopolskie (PL)	3.29	6,171
3	Brandenburg (DE)	3.28	5,489
4	Münster (DE)	3.19	5,445
5	Mecklenburg-Vorpommern (DE)	3.19	3,868
6	Zeeland (NL)	3.16	1,201
7	Schleswig-Holstein (DE)	3.1	5,807
8	Sachsen-Anhalt (DE)	3.03	5,148
9	Kujawsko-Pomorskie (PL)	2.91	2,933
10	Gelderland (NL)	2.82	5,366

Source: European Cluster Observatory, 15.10.2011.

Table 3.13. Ranking of clusters according to NACE Rev. 1.1, group 15.1: Production, processing and preserving of meat and meat products

No.	Region	Specialisation indicator	Employment
1	Bretagne (FR)	6.05	28,613
2	Del-Alfold (HU)	5.19	14,453
3	Warmińsko-Mazurskie (PL)	4.75	7,558
4	Pays de la Loire (FR)	4.36	24,755
5	Lincs (UK)	4.16	6,053
6	Podlaskie (PL)	3.81	4,592
7	Wielkopolskie (PL)	3.54	16,440
8	Lubuskie (PL)	3.1	3,827
9	Kujawsko-Pomorskie (PL)	3.09	7,734
10	Łódzkie (PL)	2.98	9,467

Source: European Cluster Observatory, 15.10.2011.

Table 3.14. Ranking of clusters according to NACE Rev. 1.1, group 15.3: Processing and preserving of fruit and vegetables

No.	Region	Specialisation indicator	Employment
1	Lincs (UK)	16.33	5,757
2	Alentejo (PT)	6.75	2,015
3	West-Vlaanderen (BE)	6.74	3,439
4	Lubelskie (PL)	6.71	3,375
5	Łódzkie (PL)	5.42	4,168
6	Kujawsko-Pomorskie (PL)	5.26	3,187
7	Podlaskie (PL)	5.1	1,488
8	Peloponnisos (GR)	5.01	1,766
9	Wielkopolskie (PL)	4.88	5,489
10	Campania (IT)	4.83	8,075

Source: European Cluster Observatory, 15.10.2011.

Table 3.15. Ranking of clusters according to NACE Rev. 1.1, group 15.5: Manufacture of dairy products

No.	Region	Specialisation indicator	Employment
1	Podlaskie (PL)	10.88	5,037
2	Basse-Normandie (FR)	6	4,979
3	Lubelskie (PL)	5.38	4,285
4	Schwaben (DE)	5.35	6,776
5	Warmińsko-Mazurskie (PL)	5.07	3,099
6	Franche-Comté (FR)	5.07	3,343
7	Ipeiros (GR)	4.55	1,303
8	Łódzkie (PL)	4.11	5,018
9	Molise (IT)	4.04	691
10	Lietuva (LT)	3.83	9,243

Source: European Cluster Observatory, 15.10.2011.

Table 3.16. Ranking of clusters according to NACE Rev. 1.1, group 15.9: Manufacture of beverages

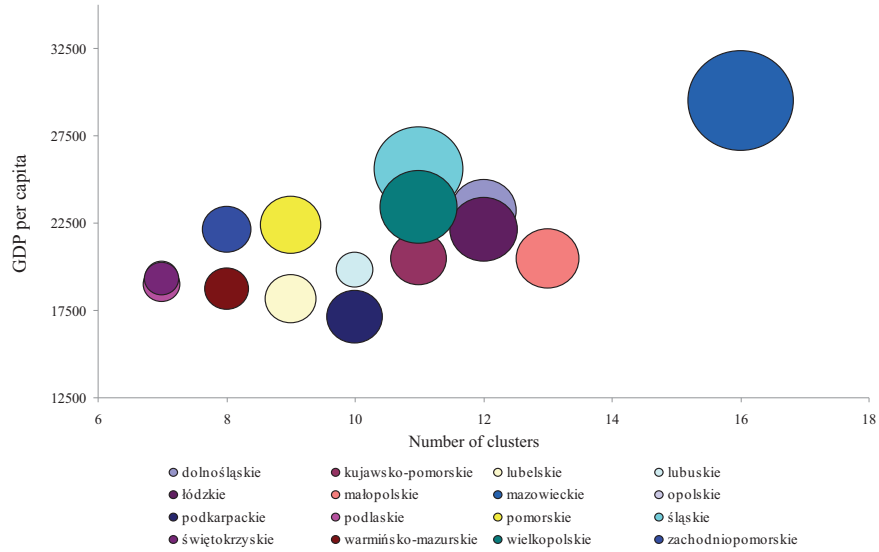
No.	Region	Specialisation indicator	Employment
1	Champagne-Ardenne (FR)	6.37	6,025
2	Podlaskie (PL)	3.39	1,910
3	Yugoiztochen (BG)	3.26	2,516
4	Cyprus (CY)	2.79	1,908
5	Yuzhen tsentralen (BG)	2.74	5,765
6	Zapadne Slovensko (SK)	2.63	2,862
7	Malta (MT)	2.61	931
8	Rheinland-Pfalz (DE)	2.59	7,948
9	Languedoc-Roussillon (FR)	2.58	4,053
10	Vlaams-Brabant (BE)	2.54	2,263

Source: European Cluster Observatory, 15.10.2011.

For groups 01.1, 01.2 and 01.3 the regions with the highest rates of specialization are primarily Bulgarian, Romanian and Greek. Polish regions (voivodeships) are characterised by relatively high location quotients for group 01.4 (1st, 2nd and 9th place), group 15.1 – Production, processing and preserving of meat and meat products (3rd and 6th till 10th place), group 15.3 – Processing and preserving of fruit and vegetables (4th till 7th and 9th place) and group 15.9 – Manufacture of beverages (2nd place).

The *European Cluster Observatory* indicated 161 structures in Poland that have at least one of the three characteristics: size, specialisation or focus. Most clusters are located in the following voivodeships: Mazowieckie (16), Małopolskie (13), Łódzkie (12) and Dolnośląskie (12). In Poland the spatial differences in the number of clusters in the NUTS 2 regions reflects the differences in the level of economic development of voivodeships. Figure 3.6 shows the relationship between the number of clusters in voivodeships and the level of GDP per capita ($R^2 = 0.57$). This relationship may attest to the role of clusters in building and maintaining regional competitiveness.

Figure 3.6. The occurrence and size of clusters and the level of GDP



Source: Own elaboration based on regional CSO data and data of the European Cluster Observatory, 15.10.2011.

Clusters of the agri-food sector that were identified in NUTS 2 regions in Poland are predominantly processed food clusters. Only in few cases, namely in Kujawsko-Pomorskie, Lubelskie and Mazowieckie voivodeships, strong clusters

of agricultural products were identified, which meet the criteria adopted in the mapping process (Table 3.17).

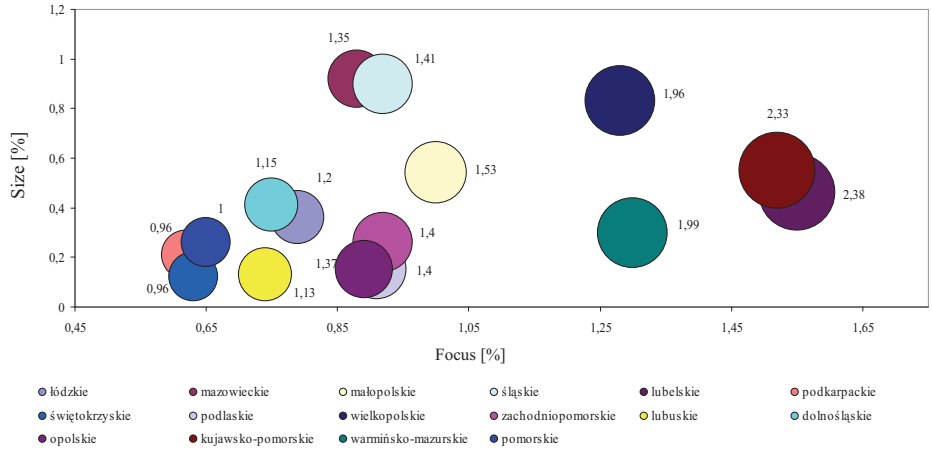
Table 3.17. The strongest clusters of agri-food products by voivodeships

Type of cluster	Cluster strength	Voivodeship
Processed food	★★★	Wielkopolskie
	★★	Kujawsko-Pomorskie, Lubelskie, Lubuskie, Łódzkie, Mazowieckie, Opolskie, Podkarpackie, Podlaskie, Śląskie, Świętokrzyskie, Warmińsko-Mazurskie
	★	Dolnośląskie, Małopolskie, Pomorskie, Zachodniopomorskie
Agricultural products	★	Kujawsko-Pomorskie, Lubelskie, Mazowieckie

Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

The size of clusters, which is a relative measure defining the share of employment in a given cluster category in a region to the employment in that cluster category in the reference region, is highly differentiated in the case of Poland. In the case of agricultural products clusters it ranges from 0.12 to 0.92%, whereas in farming and animal husbandry clusters – 0.02-0.2%, and in the processed food clusters – 0.22-1.28%.

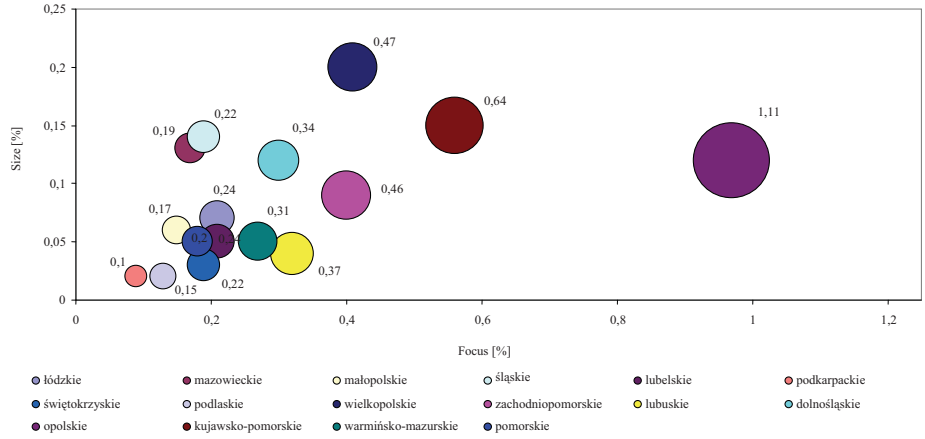
Figure 3.7. Agricultural products clusters in NUTS 2 regions in Poland



Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

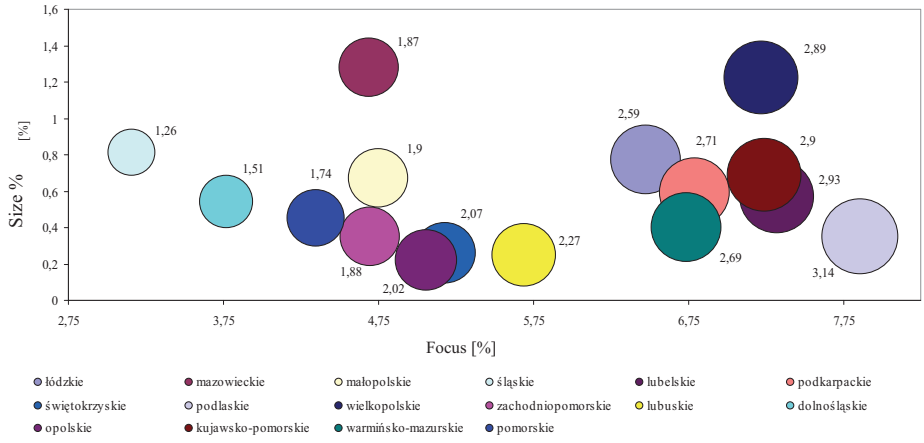
Whereas specialisation (LQ) adopts values from the following ranges 0.96-2.38, 0.1-1.11 and 1.26-3.14, respectively (Figures 3.7-3.9).

Figure 3.8. Farming and animal husbandry clusters in NUTS 2 regions in Poland



Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

Figure 3.9. Processed food clusters in NUTS 2 regions in Poland



Source: Own elaboration based on data of the European Cluster Observatory, 15.10.2011.

It should be noted that the calculations of the *European Cluster Observatory* for Poland were based on employment data for 2001. Bearing in mind the issue of keeping comparability with other countries covered by this study, this

analysis should further take into account the possibility of including the most recent data on employment.

3.3. Mapping of clusters in the American space

The American economy is highly diversified with regards to the level of economic development of individual regions. There are many theories whose authors try to explain this heterogeneity. There is particular focus on regions such as the Silicon Valley, where their strong economic position is related to innovative clusters [Delgado et al. 2011]. The Institute for Strategy and Competitiveness, being a unit of the Harvard Business School headed by Professor M.E. Porter – the author of the modern theory of business clusters, conducts comprehensive research into the methods of identification, classification and evaluation of clusters' size in the American economy. Based on the North American Industry Classification System (NAICS) Porter uses a typology which distinguishes three groups of business activities:

- local industries,
- traded industries;
- resource-dependent – natural endowment industries.

The criterion for separation of these activities depends on the way of their distribution in space. A local industry is characterised by a proportional distribution with regards to the population. Its offer is addressed mainly to local entities, thereby reducing the risk of competition from entities from other regions. In turn, a traded industry includes these types of goods and services which are offered to buyers mainly from outside of the local market. The last group, a resource-dependent – natural endowment industry, includes companies offering their products and services also to the broad market, but their location is strongly linked to the occurrence of natural resources [Porter 2003].

With reference to this classification on the grounds of the theory of clusters, local clusters, traded clusters and natural endowment industry (NED) clusters may be distinguished. Traded clusters include industries that compete in different regions, but their presence is concentrated in selected locations. They are recognised as the driving force of the regional economy and its competitiveness. These clusters do not occupy the first place in the United States in terms of employment, but they generate the highest wages in the economy. Moreover, they are the most efficient. The situation is different in the case of local clusters. Typically, their employment rates are the highest among all clusters. Their efficiency and market success, however, depend on the position and development of traded clusters. NED clusters, concentrated in specific locations, are characterised by declining market share in employment [Porter 2011].

Due to specific regional conditions the distribution of the above-mentioned types of clusters in the state economies is not even. According to estimates presented under the implementation of the *Cluster Mapping Project* in 2009 in the USA employment in local clusters reached 72.1%, in trade clusters it was 26.9%, while in NED clusters it was only 1%. They offered total annual wages at the level of USD 37,278, USD 56,906 and USD 40,272, respectively [Porter, *Cluster Mapping Project*].

According to the methodology developed with the aim of cluster mapping under the Cluster Mapping Project 41 categories of traded clusters, 16 local clusters and 10 NED clusters with several sub-clusters were distinguished. Sub-clusters are groups of related business activities within a cluster, which are better correlated between each other than with other component elements of the cluster [Porter 2003].

Among the traded clusters the categories related to the agri-food sector are: agricultural products clusters (seven sub-clusters[15]) and processed food clusters (thirteen sub-clusters[16]). Moreover, one of the local clusters focuses on activities involving processing and distribution of food and beverages, and one of the NED clusters is an agricultural products cluster.

The employment figures used in the process of isolating the cluster structures in the economic space can be replicated in most of the clusters. As a result, any type of business activity can be a part of, on average, two separated clusters [Porter 2003].

The USA economy is characterised by spatial diversity, which can be analysed, for instance, on the state level. In the case of agricultural products and processed food clusters the largest share of employment in a given cluster category belongs to California and it amounts respectively to: 27.4% and 10.6%, while the LQ stands at 2.44 and 0.94. Ten states with the largest share of employment in the agricultural products clusters concentrate 65.2% of employees in this type of clusters across the United States (Table 3.18).

[15] Sub-clusters: agricultural products (37.2% employed in the cluster), farm management and related services (30%), irrigation systems (12.4%), packaging (1.9%), fertilizers (2.1%), wine and brandy (12.1%), milling and refining (4.3%) [Porter, *Cluster Mapping Project*].

[16] Sub-clusters: milk and frozen desserts (6.1%), baked packaged food (18%), coffee and tea (1%), processed dairy and related products (4.7%), meat and related products and services (23%), flour (2%), specialty foods and ingredients (15.9%), milling (6.7%), candy and chocolate (4%), malt beverages (2%), paper containers and boxes (11.7%), metal and glass containers (3.6%), food products machinery (1.2%) [Porter, *Cluster Mapping Project*].

Table 3.18. The largest agricultural products clusters in the USA in 2009

No.	State	Share in national employment	LQ
1.	California	27.40	2.44
2.	Florida	8.28	1.38
3.	Washington	5.90	2.83
4.	Texas	4.73	0.61
5.	Oregon	3.45	2.90
6.	Idaho	3.43	7.85
7.	Wisconsin	3.31	1.61
8.	New York	3.25	0.51
9.	New Jersey	2.80	0.93
10.	Illinois	2.68	0.6

Source: Own elaboration based on Porter, Cluster Mapping Project.

In the processed food clusters the combined share of the ten largest states is 54.2% (Table 3.19). Out of the 10 compared states, the highest LQ value amounting to 3.92 and attesting to a high degree of specialization in this field of activity belongs to Iowa. In the case of separated agricultural products sub-clusters the greatest spatial concentration occurs in the case of wine and brandy sub-clusters. California is the state which concentrates 67.6% of its national employment (Table 3.20).

Among the indicated processed food sub-clusters the highest TOP-2 value was reported in the sub-cluster of processed dairy and related products. Wisconsin and California employ 40.5% of all of the employed in this sub-cluster across the country [Porter, *Cluster Mapping Project*]. The spatial distribution of the agricultural products activities based on natural resources shows that the largest share of employment in this cluster category takes place in the states of Minnesota and Kentucky (Table 3.21). It is 11.8 and 11.4%, respectively.

Table 3.19. The largest processed food clusters in the USA in 2009

No.	State	Share in national employment	LQ
1.	California	10.56	0.94
2.	Illinois	6.63	1.48
3.	Texas	6.54	0.84
4.	Pennsylvania	5.49	1.25
5.	Wisconsin	4.92	2.39
6.	Ohio	4.77	1.22
7.	Iowa	4.40	3.92
8.	New York	3.73	0.58
9.	Minnesota	3.58	1.7
10.	Missouri	3.55	1.72

Source: Own elaboration based on Porter, Cluster Mapping Project.

Table 3.20. The largest wine and brandy clusters in the USA in 2009

No.	State	Share in national employment	LQ
1.	California	67.61	6.03
2.	Washington	5.45	2.61
3.	Oregon	4.27	3.59
4.	New York	4.21	0.66
5.	Texas	1.59	0.2

Source: Own elaboration based on Porter, Cluster Mapping Project.

California, who is the leader among the traded clusters of agricultural products, is ranked as tenth (3.6% of total employment). In the case of the ten largest local clusters, which focus on processing and distribution of food and beverages, LQ index is close to 1. This fact is largely due to the nature of these clusters, namely the proportional distribution of their activities with regards to the population of the region (Table 3.22).

Results of cluster mapping in the USA economy are also available in other spatial sections. This allows going beyond the scheme of state classification and isolating cluster structures within states and between them.

Table 3.21. The largest NED clusters of agricultural products in the USA in 2009

No.	State	Share in national employment	LQ
1.	Minnesota	11.82	5.6
2.	Kentucky	11.40	8.78
3.	Michigan	9.98	3.38
4.	Idaho	9.65	22.1
5.	Illinois	9.47	2.12
6.	Iowa	5.68	5.07
7.	Ohio	5.61	1.44
8.	Indiana	4.70	2.19
9.	North Dakota	4.44	17.2
10.	California	3.61	0.32

Source: Own elaboration based on Porter, Cluster Mapping Project.

Table 3.22. The largest local clusters of food and beverages processing and distribution in the USA in 2009

No.	State	Share in national employment per cluster	LQ
1.	California	12.05	1.07
2.	Texas	7.07	0.91
3.	New York	6.85	1.07
4.	Florida	6.14	1.02
5.	Pennsylvania	4.93	1.12
6.	Illinois	4.14	0.93
7.	New Jersey	3.77	1.25
8.	Ohio	3.54	0.91
9.	Massachusetts	3.01	1.16
10.	Georgia	2.83	0.95

Source: Own elaboration based on Porter, Cluster Mapping Project.

4. Examples of global agri-food clusters

4.1. California wine cluster

The economy of the United States is characterised by a high share of services sector in its GDP structure. In 2010, they accounted for 76.6% of GDP, while the industrial sector accounted for 22.2% of GDP and the agricultural sector accounted for 1.2%. The percentage of people employed in agriculture, forestry and fisheries in 2009 was at the level of 0.7% [www.cia.gov].

California is the largest of the fifty state economies of the United States. In 2010, the gross state product at the level of USD 1.9 trillion accounted for 13% of the gross domestic product of the United States [www.bea.gov]. According to the International Monetary Fund, the economy of California, separated from the structure of the country would be ranked ninth among the largest economies of the world [www.imf.org].

California has the highest share in the sale value of agricultural products in the country. In 2007, the value was at 11.4%, but in absolute terms the sale of agricultural products stood at the level of USD 33.9 billion. In California, 68% of agricultural production is plant production, the remainder – 32% is livestock production [USDA 2010a].

One of the main types of agricultural production in the USA is the cultivation of fruit, nuts and berries, which in 2007 accounted for 6.3% of the value of sold production of agricultural products (fifth place in the country) [USDA 2010a]. States, in which fruit production is the largest, are California (more than half of the harvest area), Florida (over 10%) and Washington (about 8%). In 2010 total production of fruit, nuts and berries in California amounted to 16.2 million tons, which represented 52% of national production, while the production value amounted to USD 13.3 billion. These results indicate an increase in production and its value compared with the previous year respectively by 7 and 12%. The production of fruit (excluding citrus fruit), and nuts in this state represented 63% of the national production, while in terms of value it was 67%. In the category of citrus fruit California reached a share of 32% (45% in terms of value) [USDA 2010b].

Grapes occupy the top rank in the Californian fruit and nuts production value. This value in 2010 amounted to USD 3.2 billion. Grape cultivation in California represents 90% of their crops in the United States [USDA 2010b]. In recent years, the grapes acreage has grown in the whole country as well as in California. In 2007 and 1997, the cultivation area of grapes in the United States was at the level of 1,051,407 and 986,213 acres, respectively [USDA 2010a].

Changes in the cultivation area, volume and value of production in California are shown in Table 4.1.

Table 4.1. Cultivation area, volume and value of grape cultivation in California

Year	Crop yielding area of cultivation [acres]	The remaining area of cultivation [acres]	Crops per acre [tons]	Production [tons]	Value per unit of production [USD/ton]	Value [USD thousand]
2001	803,000	107,000	7.45	5,979,000	446	2,666,579
2002	820,000	85,000	8.17	6,696,000	383	2,566,918
2003	819,000	63,000	7.16	5,861,000	402	2,324,650
2004	800,000	53,000	7.03	5,623,000	492	2,764,534
2005	800,000	61,000	8.7	6,963,000	459	3,197,820
2006	797,000	63,000	7.18	5,726,000	524	2,999,958
2007	789,000	59,000	7.9	6,230,000	494	3,075,614
2008	786,000	58,000	8.33	6,548,000	446	2,922,226
2009	789,000	54,000	8.29	6,544,000	497	3,260,172
2010	792,000	50,000	8.48	6,716,000	477	3,201,112

Source: Own elaboration based on data from USDA 2010b.

In California the grapes are cultivated for the purpose of consumption, production of wine and production of raisins. In the structure of crops, grapes for wine production have the largest share. They are followed by varieties of grapes cultivated for the production of raisins and for consumption. Table 4.2 presents summary data on the cultivation area, volume and value of grape cultivation in California in 2010.

Table 4.2. Cultivation area, volume and value of grape cultivation in California according to criteria of use

Use	Area of yielding cultivation [acres]	Crop per acre [tons]	Production [tons]	Value per unit of production [USD/ton]	Value [USD thousand]
Wine production	497,000	7.30	3,629,000	576	2,090,886
Raisins	210,000	9.90	2,079,000	349	724,610
Consumption	85,000	11.90	1,008,000	383	385,616

Source: Own elaboration based on data from USDA 2010b.

The tradition of wine production in California derives from the first crops, which were established in the eighteenth century by Spanish missionaries for sacred needs. Over time, vineyards established for private purposes started to appear, and eventually commercial wine production began. Wine consumption in the United States is characterised by an upward trend. It is especially noticeable over the last two decades. Wine consumption in 2010 was by 54% higher than in 1990, and the annual increase in consumption in the analysed period averaged 2.18% (Table 4.3). High domestic demand was and still is one of the reasons for development of the wine cluster in California.

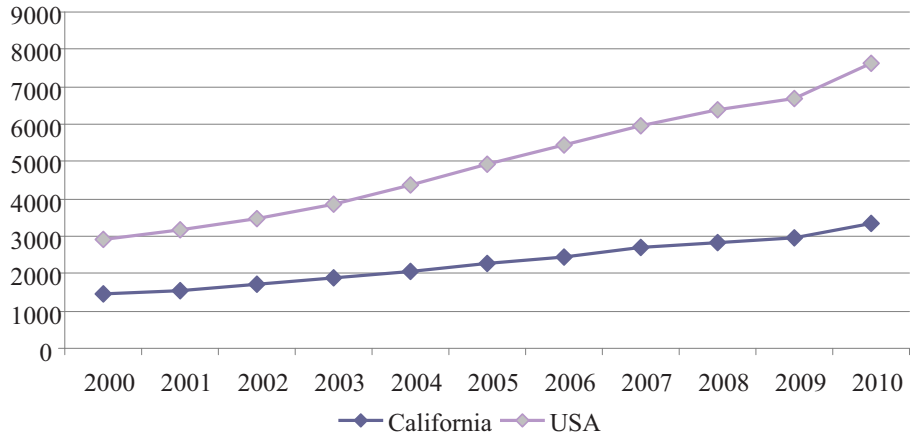
Table 4.3. Wine consumption in the USA in 1940-2010

Year	Litres per capita	Total consumption [million litres]
2010	9.61	2967.76
2000	7.61	2150.11
1990	7.76	1926.77
1980	7.99	1817.00
1970	4.96	1010.70
1960	3.44	617.02
1950	3.52	529.96
1940	2.57	340.69

Source: Own elaboration based on Wine Institute data www.wineinstitute.org.

In the United States wine production in 2009 amounted to 2,777 million litres. The United States ranked fourth among the largest producers of wine in the world, behind France, Italy and Spain. Global market share of these countries in 2009 was 17.56%, 17.38%, 14.20% and 10.38%, respectively. In recent years, there has been a significant weakening of the traditional leading role of the European economies in wine production for the benefit of the so-called New World countries, especially the USA and Chile [www.wineinstitute.org]. In the United States there is a significant increase in the number of wine producers, taking place both in California and in other locations (Figure 4.1).

Figure 4.1. Licensed wine producers in California and the USA



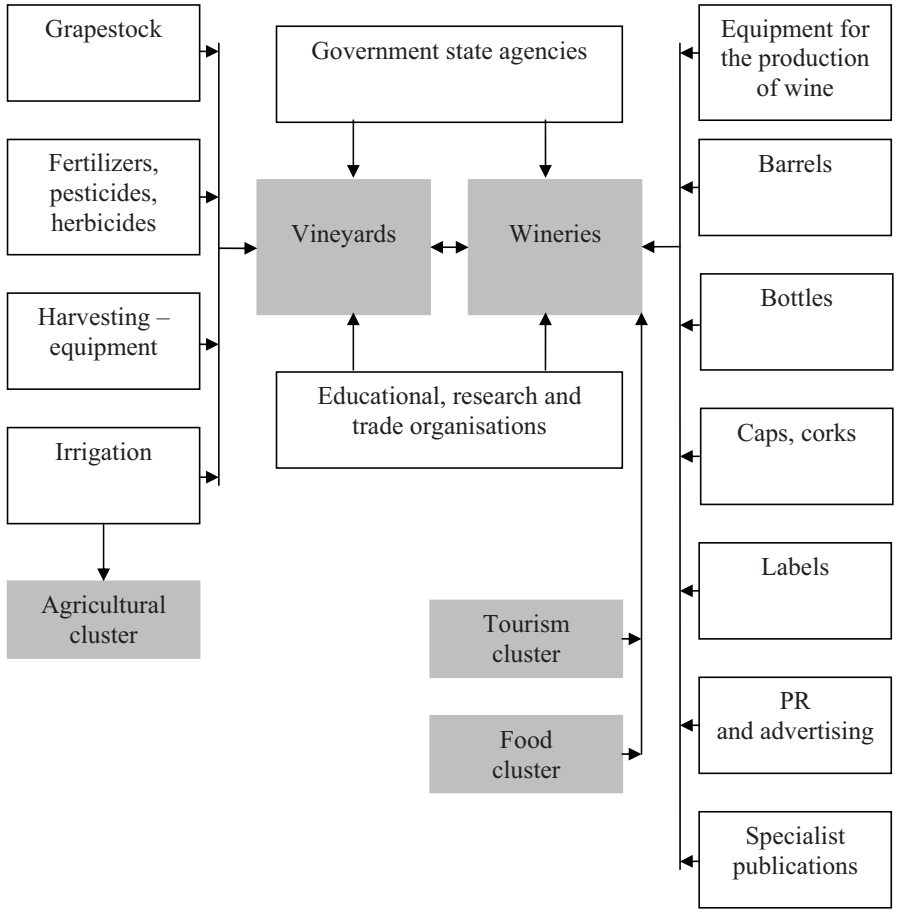
Source: Own elaboration based on Wine Institute data www.wineinstitute.org.

The United States is one of the main exporters and importers of wine in the world. In 2010, the list of the biggest exporters of wine was as follows: European Union – 41%, Australia – 16%, Chile – 15%, South Africa – 8%, the USA – 8%, other countries – 12%. The biggest wine importer in the world was the European Union – 31%. The next major target markets were: the USA – 21%, Russia – 12%, Canada – 8%, China and Hong Kong – 7%. Other countries accounted for 21% of global imports [USDA 2011a].

Areas in California that specialise in grape cultivation and wine production include: San Joaquin Valley (including the counties of: Fresno, Kern, San Joaquin, Madera, Tulare and Merced), Central Coast (including the counties of: Sonoma, Napa, Monterey and San Luis Obispo), Sacramento Valley (including among others the Sacramento county) and the Northern Coast (including Mendocino county) [USDA 2011b].

The structure of the wine cluster consists of several generic groups of entities (Figure 4.2). On the one hand, it is made of vineyards and wineries forming the core of the cluster. Around them, other entities involved in the wine production process are concentrated. On the part of suppliers operating together with vineyards, the cluster is formed by wine-growers, producers of plant protection products, fertilizer manufacturers, equipment suppliers (e.g. used in harvesting), or the manufactures of irrigation systems. Wine producers are supplied by manufacturers of wine production equipment and packaging (barrels, bottles, caps, corks, labels).

Figure 4.2. California wine cluster



Source: Own elaboration based on Porter 1998a.

Moreover, wine producers also cooperate closely with providers of marketing services, including PR and advertising. The added value is created by a number of specialist publications, including industry magazines. Given the existence of agglomeration of winemakers and grape growers, California has developed a number of connections which play a significant role in the functioning of the cluster. Supporting industries provide knowledge and experience and they effectively influence and improve the competitiveness of the sector as well as the region. On the part of state agencies support is provided by the Select Committee on Wine, acting by authority of the State of California.

The significance of that cluster in the Californian economy is also evidenced by the fact that the University of California in Davis conducts study programmes in the field of viticulture and enology [www.caes.ucdavis.edu] and research in this area. In addition to the education and R&D sector, support for the operation of the cluster is also provided by industry organisations. These include the Wine Institute, which represents more than 10,000 companies in the wine industry. The tasks of this entity include: supporting policy initiatives for the development of the economy of California and the United States, elimination of trade barriers for exports of Californian wines, their global promotion, supporting research in the field of enology, recommendation of practices aimed at sustainable development of the industry and responsible consumption of alcohol [www.wineinstitute.org].

The wine cluster in California is a perfect example of the occurrence of relationships that exist between clusters of different profiles within a region. Relationships of the California wine cluster concern agricultural, food and tourism clusters. In the latter case, the relationship applies to the popular forms of tourism, which in California is enotourism. In recent years the Wine Institute estimates its value at USD 2.1 billion per year.

4.2. Dutch flower cluster

The Netherlands is one of the smallest countries of the European Union. Despite this, more than half of the total area of the country, amounting to more than 4 million hectares, is designated for agricultural activities [Ministerie van Landbouw, Natuur en Voedselkwaliteit 2010]. In 2010 the level of GDP in the Netherlands amounted to USD 783.3 billion (USD 705.6 billion of PPP) and represented 0.91% of GDP of PPP in the world, with GDP per capita amounting to USD 47,172. In addition, the Netherlands ranks high in competitiveness rankings. In 2011, it was ranked seventh by the World Economic Forum (a year before it was eight, and two years before tenth) [World Economic Forum 2011]. The Netherlands, included in the group of highly developed countries, also leads in the global rankings of exports value. In 2010 the value of Dutch exports, according to estimates of International Trade Centre, amounted to USD 492.6 billion (3.3% of world exports and sixth position in the world). In 2010, the value of imports in the Netherlands was USD 440 billion (2.9% of world imports and ninth position in the world) [ITC 2011].

Agri-food sector is one of the pillars of the Dutch economy and the export and import of agricultural products is one of the most important components of international trade. In 2010, agricultural products accounted for 16.4% of the total Dutch exports and 11.9% of imports [WTO 2011]. The most important

product categories in international trade include flowers, fruit and vegetables, cheese and other dairy products, meat or seeds (Table 4.4).

Table 4.4. Ranking of products exported from the Netherlands in 2010

No.	Products	Share of exports value
1.	Nuclear reactors, boilers, etc.	14.14%
2.	Mineral fuels and oils, etc.	13.63%
3.	Electrical machines and equipment, etc.	9.15%
4.	Not classified	6.77%
5.	Pharmaceutical products	5.42%
6.	Organic chemicals	4.43%
7.	Plastics etc.	4.10%
8.	Instruments and apparatus – optical, photographic, etc.	3.75%
9.	Vehicles other than railway and their parts and accessories	2.76%
10.	Iron and steel	2.73%
11.	Live trees and other plants (including cut flowers)	1.70%
12.	Miscellaneous chemical products	1.56%
13.	Dairy products etc.	1.54%
14.	Meat and edible meat offal	1.50%
15.	Vegetables and certain edible roots and tubers	1.38%
16.	Others	25.44%

Source: Own elaboration based on data from ITC www.trademap.org.

The trade is predominantly within the confines of the Old Continent, and the largest trading partner of the Netherlands is the Federal Republic of Germany (Table 4.5). Trade with Poland accounts for less than 2% of Dutch exports. Globally, the Netherlands ranks second as exporter of agricultural products, second in this respect only to the United States [Ministerie van Landbouw, Natuur en Voedselkwaliteit 2010].

Growing flowers in the Netherlands has a long tradition. Despite the unfavourable natural conditions, the country is a leading producer of cut flowers in the world, ahead in this regard of others, more climatically favoured locations.

In 2010, 62.99% of exports of cut flowers in the world came from the Netherlands. The second in this respect, Colombia provided 16.05% of world exports (Figure 4.3). On the other hand, as shown in Figure 4.4, the main importers of cut flowers in the world are the Federal Republic of Germany (21.07%), United Kingdom (15.36%) and the United States (14.36%).

Table 4.5. Export destinations for the Netherlands in 2010

No.	Total exports		Cut flowers exports	
	Partner	Share of exports value	Partner	Share of exports value
1.	Germany	24.30%	Germany	30.09%
2.	Belgium	11.11%	UK	17.06%
3.	France	8.75%	France	14..32%
4.	UK	7.98%	Switzerland	4.46%
5.	Italy	5.02%	Italy	3.95%
6.	USA	4.54%	Russian Federation	3.79%
7.	Spain	3.39%	Belgium	3.72%
8.	Poland	1.99%	USA	2.89%
9.	Sweden	1.79%	Austria	2.67%
10.	Russian Federation	1.52%	Denmark	1.79%
---	Others	29.62%	Others	15.27%

Source: Own elaboration based on data from ITC www.trademap.org.

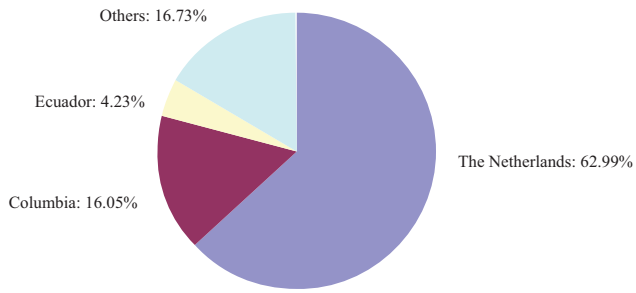
The Dutch flower cluster is located in two provinces of North Holland and South Holland. In recent years the flower cultivation area in the Netherlands has been decreasing, while the proportion of growing flowers in greenhouses is gradually increasing. At the same time, in recent years, there has been a decline in the number of producers (Table 4.6).

The process of creating value in the case of the flower cluster is associated with the operation of a range of entities representing different areas of economic activity, which play different roles in it. The core activity of the cluster is growing flowers (Figure 4.5).

In the Netherlands the main factors that determined the competitiveness of the analysed cluster and still play a major part in this respect, are: the historical context, location in close proximity to markets characterised by high demand, but also high domestic demand, close cooperation between growers and the research and development area, expanded auction system and cooperation between producers[17].

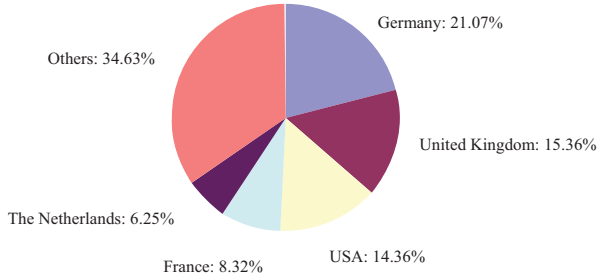
[17] In order to get acquainted with one of the most interesting periods in the history of the Dutch flower cluster, we recommend reading a paper by Garber [1989]. The paper describes a spectacular speculative bubble that developed on the bulbs market (tulips), and which reached its peak in the years 1634-1637.

Figure 4.3. The structure of world exports of cut flowers in 2010



Source: Own elaboration based on data from ITC www.trademap.org.

Figure 4.4. The structure of world imports of cut flowers in 2010



Source: Own elaboration based on data from ITC www.trademap.org.

Table 4.6. Cultivation area of flowers and number of producers

Year	Cultivation area [ha]	Greenhouse cultivation [%]	Number of producers	Number of producers – greenhouses
2000	6,279	40.64%	4,112	2,251
2001	5,985	39.75%	3,788	2,097
2002	6,262	42.86%	3,576	1,955
2003	6,106	42.70%	3,454	1,850
2004	5,929	42.64%	3,255	1,823
2005	5,763	43.61%	3,026	1,736
2006	5,696	45.70%	2,818	1,677
2007	5,576	46.14%	2,248	1,522

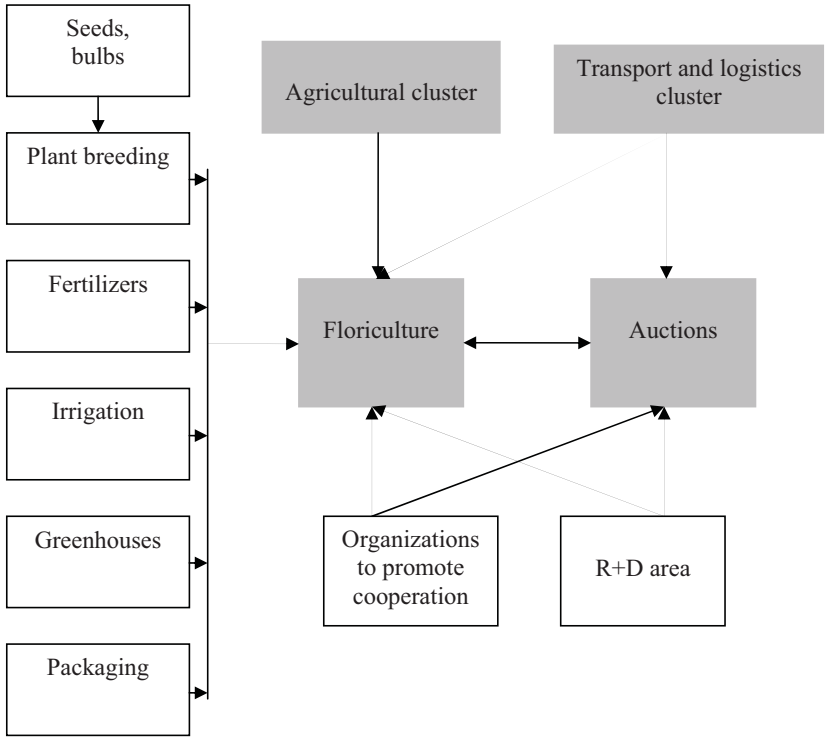
Source: Own elaboration based on Porter et al. 2011.

Equally important for the competitiveness of the cluster are logistics and flower distribution systems, as one of the main links of the process of delivery from the grower to the customer. It is the Netherlands where the main flower trade routes coming from all over the world meet. Some plants are imported to Holland, and then offered for re-export.

Dutch auction system, used for the sale of flowers, was created for the sale of goods that rot rapidly. The largest auction system is FloraHolland, a network consisting of six auction centres (five in the Netherlands: Aalsmeer, Bleiswijk, Eelde, Naaldwijk, Rijnsburg and one in Germany: Veiling Rhein-Maas), which carry out daily an average of 120,000 purchase and sale operations [www.floraholland.com].

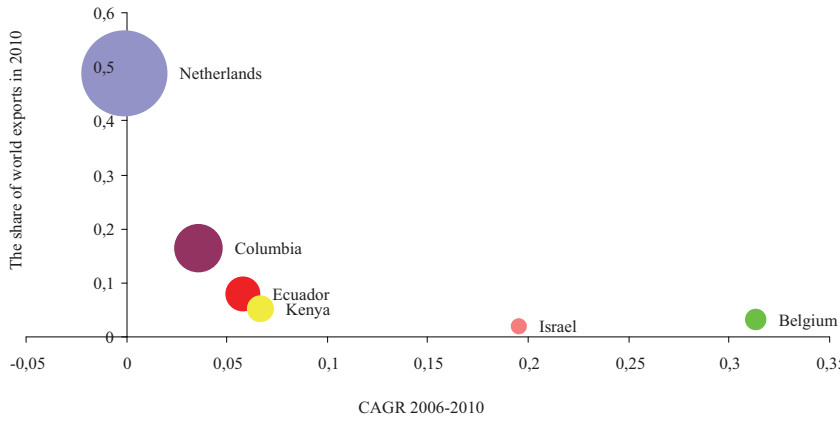
Currently, the Dutch flower cluster is forced to compete with other locations, where there is an increase in the number of producers of flowers. Due to their favourable climatic conditions, such countries as Colombia, Ecuador, or Kenya orient themselves towards this profile of activities. The leading position of the Netherlands in the world still seems not to be threatened. Analysing data on exports in 2006-2010, it can be concluded that the Netherlands is in this respect a definite leader in the world (48.67%), although in this period its CAGR (Compound Annual Growth Rate) stood at -0,13% (Figure 4.6). In the case of Colombia, ranked second in the world, the share of world exports is 16.35%, while the CAGR in 2006-2010 was at 3.6%.

Figure 4.5. The Dutch flower cluster



Source: Own elaboration based on Porter et al. 2011.

Figure 4.6. The share in cut flowers export and its dynamics in 2006-2010



Source: Own elaboration based on data from ITC www.trademap.org.

Other countries included in this ranking on further positions also reported higher CAGR values (Ecuador – 5.78%, Kenya – 6.66%, Israel – 19.51%, and Belgium – 31.29%).

The Dutch agricultural sector is supported by a number of research and development units. The main academic centres supporting the sector are universities in Wageningen, Maastricht, Groningen, Leiden and Rotterdam. Agriculture, playing a special role in the economy of the Netherlands, is also at the centre of attention of the authorities responsible for creation and implementation of economic policy. The current policy in the field of agriculture, in addition to the desire to ensure the conditions for the efficient and effective competition in the European and world markets, also puts special emphasis on food safety, animal welfare or the impact of human activities on the green areas [Ministerie van Landbouw, Natuur en Voedselkwaliteit 2010].

Summary

The cluster concept originating from Marshall has become very popular in recent years, mainly due to the work of M.E. Porter, which give it its new meaning, useful in the creation of economic policies aimed at increasing the competitiveness of the economy or specific sectors such as agri-food sector. Formulation of relevant assumptions for these policies requires research and analysis on the factors determining the formation and development of clusters in a given economic environment. While we can talk about certain universal conditions of formation and development of clusters, the collection and importance of individual causative factors may be strongly dependent on the specifics of the economy, having an influence on the sectoral specialisation.

The analysis of the economic and institutional conditions of formation and development of clusters in the Polish agri-food sector shows that this process should benefit primarily from supply-side factors associated with considerable potential for the manufacturing sector. Less favourable, especially in the long--term perspective, can be the effect demand factors. The success of companies operating in the food markets and related entities will depend on the perception of objective consumer trends and skilful adaptation to them. An important role will be played by structural and institutional factors, which are now hardly a strong case for the development of agri-food clusters. The most serious problem is the minimal involvement of R&D in the functioning of the cluster structures.

Different methods are used to identify and study clusters, both quantitative and qualitative ones. Their applicability, particularly of quantitative methods, is often highly dependent on the availability of relevant data. Given the methodological difficulties associated with this fact, and a variety of analysis it will be difficult to draw firm conclusions about the prevalence and strength of certain clusters, and in particular their role in building a competitive economy.

It seems that the cluster analysis aimed at formulating appropriate policies has to combine the quantitative approach based on the statistical methods with qualitative approach, using methods such as directed interview or case study. In light of this, support bottom-up cluster initiatives and top-down organisation of clusters can be easily ineffective without conducting appropriate analyses to verify the facts, resulting from the circumstances, the economic potential of created or developed cluster structures. It also means that any cluster policy should be selective in nature. Specifying the objectives of this policy should be based on a system of sufficiently detailed mapping and study of clusters in terms of improving cooperation and strengthening the ties between entities belonging to them. This is of particular importance in the Polish agri-food sector, which be-

cause of the historical legacy of attitudes to different forms of co-operation is still marked by distrust and fear of violating individual interests.

Compared to those in some European Union countries, as well as in the USA, the clusters identified in Poland and associated with the agri-food sector are relatively weak. The fact that, relatively speaking, they appear more markedly in the processing industry than in primary agricultural production should be considered as a positive thing, though. This demonstrates the possibilities of achieving a higher level of expertise for the development of export products with high added value. The examples of global clusters shown in the formula of abbreviated case study examples provide evidence that the formation of such clusters is organically linked with advanced and highly competitive international economies. At the same time, it confirms the thesis that building strong export-oriented clusters can be an effective way leading to a relatively rapid increase in the competitiveness of selected industries of agri-food sector in Poland.

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