CHAPTER 12

THE FLEMISH FROZEN-VEGETABLE INDUSTRY AS AN EXAMPLE OF CLUSTER ANALYSIS

Flanders Vegetable Valley

WIM VANHAVERBEKE[#], JAN LAROSSE[##] AND WOUTER WINNEN[###]

[#]*Universiteit Hasselt, Belgium, and Technische Universiteit Eindhoven, The Netherlands*
[##]*IWT-Vlaanderen, Belgium*
[###]*Katholieke Universiteit Leuven, Belgium*

INTRODUCTION

In this contribution we present a strategic analysis of the cluster dynamics in the frozen-vegetable industry in Flanders (Belgium)[1]. The main purpose of this case is twofold. First, we determine the added value of using data about customer and supplier relationships in cluster analysis. Second, we experiment with a methodology for analysing the cooperation and cluster formation in competitive niche markets by combining various quantitative and qualitative sources of information.

DESCRIPTION OF THE SECTOR

The Flemish frozen-vegetable sector is a very specific industrial sector. It is concentrated in the area around Roeselare, a midsized town located in the centre of the province of West-Flanders (Belgium). There are 18 Belgian frozen-vegetable producers and 17 of them are located in this small geographical area. In this section we analyse the Flemish frozen-vegetable industry in detail. First, we focus on the history of the industry. Next, we analyse the strategic factors that shape the industry and that are key drivers of the competitive strength of the companies in this sector.

W. Hulsink and H. Dons (eds.), Pathways to High-tech Valleys and Research Triangles: Innovative Entrepreneurship, Knowledge Transfer and Cluster Formation in Europe and the United States, 249-274.

History

The frozen-vegetable industry in West-Flanders is deeply rooted in the entrepreneurial tradition that characterizes the region. At the end of the 19th Century, West-Flanders was one of the better-known flax-producing regions in the world. The emergence of synthetic fibres around 1950 led to a restructuring of local industry: flax became less important and new sectors developed, including the production of chipboard, vegetable oils, tapestries, textiles and frozen vegetables. The frozen-vegetable industry has grown rapidly thanks to the impulse and commitment of local entrepreneurs, European agricultural subsidies, and a decline in the success of canning as a preserving technology. Consumers increasingly preferred frozen vegetables, thanks to their reputation of being healthier than canned food. Meanwhile the importance of the Flemish frozen-vegetable sector in the European market increased continuously. Because the domestic market for frozen vegetables was small, West-Flemish entrepreneurs continued their growth by focusing on exports to neighbouring markets. In addition, the internal competitive dynamics within the region allowed companies to build a competitive advantage over foreign competitors, which made it possible for the Flemish frozen-vegetable producers to become market leaders within the European market.

Strategic factors

We approach the cluster formation in the Belgian frozen-vegetable industry from four different but mutually related perspectives (cf. the ‘diamond model’ in Porter 1990): production factors, demand factors, strategy and competition, and social embeddedness.

Production factors

The natural environment in West-Flanders is favourable for growing vegetables – the basic product of the frozen-vegetable industry. A mild maritime climate and a favourable soil composition make parts of this province extremely suitable for the cultivation of vegetables. In addition, the farms in the region are family businesses that have a relatively small acreage (an average of 10-12 hectares), very suitable for intensive vegetable culture. Finally, the central location of Flanders within Europe and its excellent (road) infrastructure also add to the competitive strength of this cluster. The proximity of agricultural businesses to the frozen-vegetable producers is an enormous advantage for this sector, in particular because it means transportation times are short, which has a positive impact on both quality and costs. This symbiosis has allowed Flanders to develop into the main production location of frozen vegetables, accounting for 46% of European production. On the other hand, the sector is threatened by soil exhaustion. Although migration to adjacent regions such as Northern France or the south of the Netherlands may offer a solution, the increased distance entails additional costs, which is exacerbated by a continuing increase in road traffic; this implies that transport times and costs keep increasing, resulting in an increase of almost 10% of the variable costs of the final product.

In terms of cost management the purchase price of the raw vegetable plays a significant role. It is negotiated jointly by the entrepreneurs in the frozen-vegetable industry; this negotiation process in combination with the stable supply of vegetables allows the sector to buy fresh vegetables at a relatively reasonable price. Stable and controllable prices are important since vegetables represent 40% of operational costs. Labour costs are also considerable production costs of frozen vegetables: they represent almost 9% of operational costs. The high wages in Belgium are an important driver behind further automation in the sector. Automation became even more acute because there was a continuous shortage of suitable – technically skilled – employees in the recent past.

As a result of those investments in automation the Flemish frozen-vegetable sector not only managed to achieve a technological competitive advantage, it also increased the pressure to increase productivity, especially by the pursuit of economies of scale and improvements in continuous production processes. The resulting higher yield is in its turn a stimulus to invest in innovative technologies. Economies of scale are also driven by the ongoing concentration in the distribution sector. As distributors centralize their purchases, they manage to increase the pressure on the frozen-vegetable producers' profit margins, making cost-efficiency in the latter of the two sectors even more urgent.

Demand factors

Over 90% of the Belgian frozen-vegetable production is exported. Belgium holds a leading position within Europe since its frozen-vegetable industry represents no less that 46% of all frozen-vegetable exports in Europe. The import of frozen vegetables into Belgium is to a large extent determined by the need of the frozen-vegetable producers to import raw materials. Belgium is a net exporter: its principal export markets are the neighbouring countries and other European Union member states.

In recent years there has been a considerable increase in demand for frozen vegetables: user-friendliness, the reputation of selling high-quality and healthy food, and long storage time of frozen vegetables were important factors contributing to this competitive success. Frozen vegetables find their way to the catering sector, the retail sector and the food industry. These three large markets each represent roughly equal shares in sales. The catering and food sectors offer the highest growth potential, whereas the sales of frozen vegetables in the retail sector (for domestic use) is characterized by an increase in the own brands of the supermarket chains – to which the Flemish frozen-vegetable sector is an important supplier. Despite this upward trend in sales of own branded products, the premium brand Iglo remains the market leader in this segment.

The Flemish frozen-vegetable producers are aware of the fact that brand names are only important in the retail sector. However, building a strong own brand would not be profitable in the short term. Moreover, the catering and food industry pay hardly any attention to brand reputation. This is the reason why frozen-vegetable producers market their products not only using own brands. They are also suppliers to premium-brand producers like Iglo and Bonduelle and/or to retailers' private labels.

Strategy and competition

The West-Flemish frozen-vegetable producers are mostly independent family companies, characterized by a flat organizational structure and an absence of hierarchical decision-making. As a rule, owners, managers and staff are strongly committed to the growth of the business. At the same time, the growing capital-intensity and increasing production scale force many companies to professionalize their management. On the one hand, the local concentration of the sector and the interconnectedness of the frozen-vegetable producers (through a common history or family ties) create fierce local competition that stimulates continuous innovation, with an emphasis on automation and productivity improvement. On the other hand, competition at an international level is fierce as well: in order to maintain low prices, it is vital to operate cost-efficiently. The implementation of such a strategy leads to a situation where the West-Flemish businesses primarily supply international market leaders like Iglo and Bonduelle, and one that allows them to realize a prominent position in foreign markets.

To avoid fierce price competition, many types of differentiation strategies are applicable: the differentiation driver can be the product itself (e.g., new products), its characteristics (storage) or an increased added value for the customer (special packaging). The growth potential of the frozen-vegetable industry is probably not to be expected from sales of different frozen vegetables themselves – with stagnating demand – but in the diversification towards vegetable mixes, prepared vegetables, bio-vegetables and herbs, and possibly ready-to-eat frozen meals. Product diversification can remain within the boundaries of the frozen-vegetable industry, but it can also reach beyond its boundaries (as is practised by 'vegetable specialist' Bonduelle, a company that also serves the canned- and fresh-vegetable markets).

Recently a few West-Flemish frozen-vegetable producers have started production in Eastern Europe in order to service the local and the German market. The expansion of the European Union from 15 to 25 countries allows them to benefit fully from the advantages offered by the Eastern-European production centres: huge supply of vegetables at low prices, low production costs and a fast-growing Eastern-European demand. The chance that newcomers can threaten the position of the Belgian frozen-vegetable producers is considered to be negligible: the increasing economies of scale, specific expertise, scale and access to distribution channels all pose formidable thresholds for potential entrants. Moreover, the intense competition, low profit margins and growing pressure on prices render the market unattractive to newcomers. Since the demand for frozen vegetables seems to approach its saturation point, it is very likely that the European frozen-vegetable industry will consolidate in the future. Increased globalization of the economy may in some way increase the pressure on the sector. The family-owned producers could face financial obstacles when the required capital to finance the expansion is not available in-house. Access to external capital is becoming crucially important.

Furthermore, the competitive strength of the Belgian frozen-vegetable producers – currently based primarily on intense competition among these West-Flemish firms – could be undermined when it becomes important to work together in networks: maintaining the innovative dynamics of the ecosystem is of the utmost importance in this respect.

Social embeddedness: government and local entrepreneurs

The growth and competitiveness of the frozen-vegetable sector in West-Flanders can not be explained without having a look at the social embeddedness of the industry. The frozen-vegetable industry has grown for decades thanks to, among other things, (local) government initiatives in education, research, quality control, etc. The local entrepreneurial culture in West-Flanders is also an important determinant in explaining the dynamics of the industry. Below, we list some of the main characteristics of this entrepreneurial culture.

The geographic concentration of the frozen-vegetable sector in West-Flanders is partly rooted in the socio-economic characteristics of the region. The local business culture is characterized by a remarkable ability to organize and adapt to quickly changing circumstances (Musyck 1993; Vanhaverbeke 2000). This capability is reinforced by an urge for economic independence, the work ethics and the willingness to take risks and to establish new businesses. This resulted in an economic growth process that has been labelled as 'autonomous industrialization'. It is characterized by a network of small and medium-sized businesses, traditional skills, integration with the region's social and cultural environment, a high level of responsibility on the part of the employees, and technological innovation that encourages 'flexible specialization'.

The significance of the social network should not be underestimated either: historical and family-related bonds are characteristic of the sector, which has led to a copycat strategy and to fierce competition among each other. Relationships with suppliers also play an important role in the sector's competitive strength: the exchange of information and cooperation lead to new technologies that make the sector more competitive. These formal and informal contacts – both the contacts among the 18 producers and those with their suppliers – also encourage a mutual learning process. This allows the sector to increase its innovative dynamics, which is therefore hard to imitate and as such reinforces the sector's competitive edge.

In this section we have presented an outline of the strategic factors determining the competitiveness of the Belgian frozen-vegetable sector. The interaction between the various factors that are described above provides a unique context in which the frozen-vegetable industry has to be situated. In the next section we focus on the relationships between the frozen-vegetable producers and their suppliers.

RELATIONSHIPS WITH SUPPLIERS

An analysis of the relationships between the frozen-vegetable producers and their suppliers allows us to investigate their mutual dependence and to draw conclusions concerning relational networks and cluster formation between the two types of economic actors. The relationships are analysed on the basis of statistical data compiled by the National Bank of Belgium (NBB). For reasons of confidentiality, the NBB had to carry out a number of preparatory calculations using the available micro-data. These calculations resulted in aggregated observations that could be used to conduct this analysis of the relationship between the frozen-vegetable producers and 4,388 identified suppliers. First, we take a closer look at the

classification of the suppliers in terms of annual sales to the sector. Second, we analyse the dependence of the suppliers with regard to the frozen-vegetable sector. Finally, we have a look at the geographical characteristics of the cluster.

Classification of the suppliers

Figure 1 divides the 4,388 suppliers into supplier classes according to the total annual deliveries to the sector per supplier in 2000: 1224 suppliers account for less than € 2,500 each on an annual basis. Together this class represent a mere 0.37% of all deliveries to the sector (see Figures 1 and 2). As the annual value of the deliveries increases, the number of suppliers in each class decreases. From the € 25,000-class onwards, the interval between the consecutive classes is 10 times larger (i.e. € 25,000 instead of € 2,500), which gives the (false) impression that there is an increase in the number of suppliers per class. The last class includes all suppliers that deliver more than € 100,000 annually: this class contains 299 suppliers (see Figure 1). A more detailed analysis should focus in the first place on these most important suppliers. After all, this group (> € 100,000) represents 82% of all deliveries (see Figure 2). In other words, a small number of suppliers (299) are responsible for the bulk of all supplies, even though there are 4,388 suppliers, most of which have no structural ties with the sector.

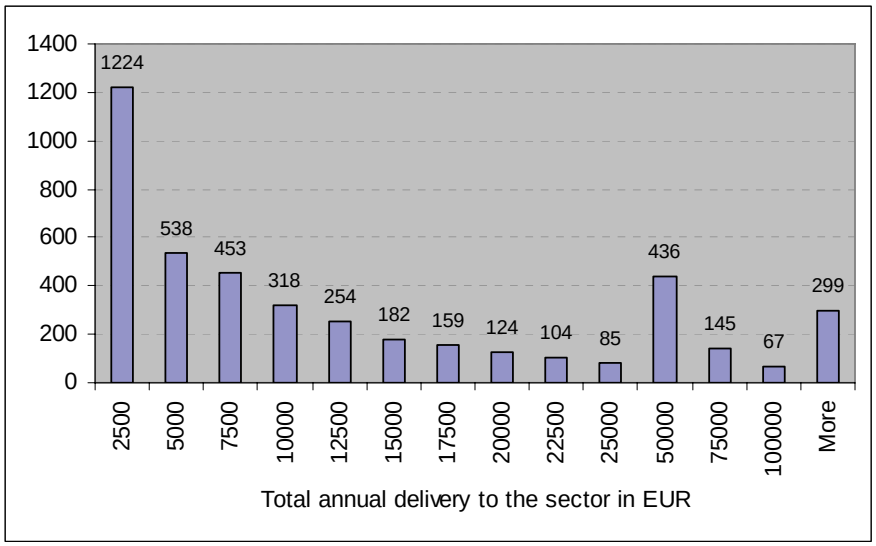

Figure 1. *Number of suppliers per supplier class (2000)*

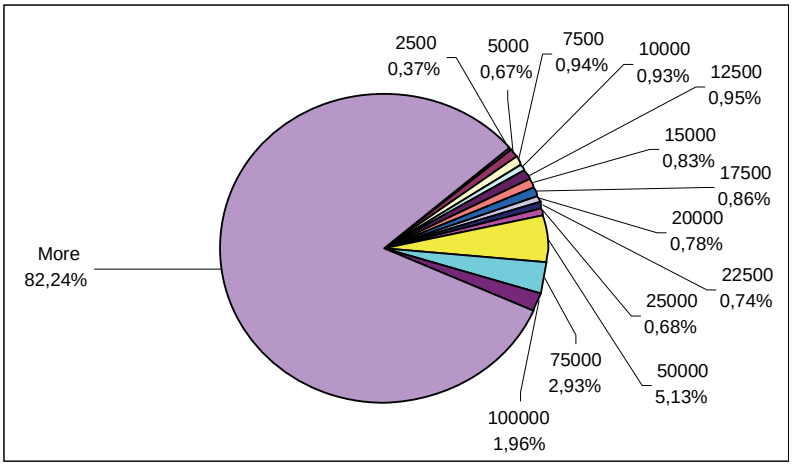

Figure 2. *Contribution per class compared to the overall deliveries to the sector (2000)*

In Figure 3, the average number of customers (among the 18 producers) for each supplier class is taken into account. The upward trend indicates that the number of customers increases when we rank the supply classes from small to large: suppliers delivering less than € 2,500 have on average 1.15 customers, those belonging to the class > € 100,000 have on average 4.47 customers. We also note that the average number of customers is fairly low, which confirms that most suppliers are selling their goods or services to a limited number of frozen-vegetable producers. It is exceptional for any company to supply its goods or services to the entire frozen-vegetable sector.

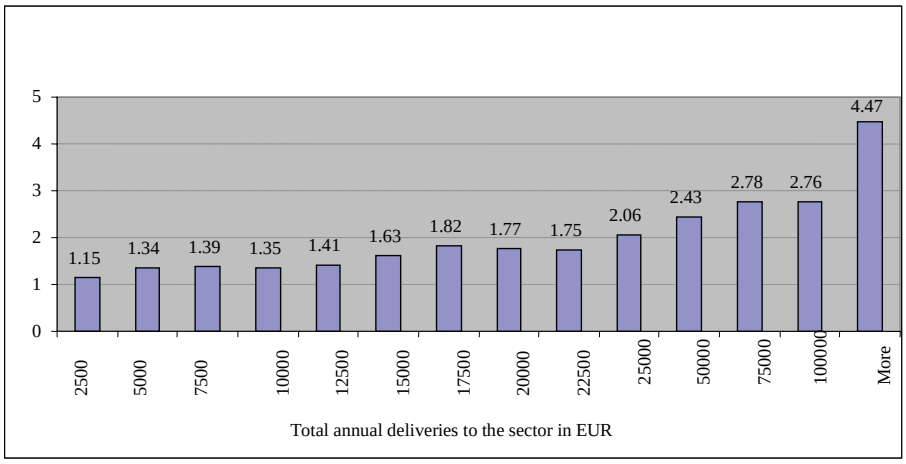

Figure 3. *Average number of customers per supplier (2000)*

Next, we focus on the average annual deliveries per client. Figure 4 shows that the average deliveries per client are increasing steadily as we move from small- to large- supplier classes. The 299 most important suppliers (> € 100,000) sell on average € 185,000 to the 18 producers. The large average volume of deliveries gives the impression that there is a mutual dependence of suppliers in this class and their clients. Their dependence is relatively high, with an average dependence of over 20%. This dependence is much smaller for the other supplier classes.

Dependence of suppliers

The dependence of the suppliers can be analysed in greater detail. Figure 5 divides the direct suppliers (i.e. the first level suppliers) of the 18 frozen-vegetable producers according to their level of dependence on this sector: 3,809 suppliers (out of a total of 4,388) depend for less that 5% on the frozen-vegetable sector (an average dependence for that class of only 0.40%). This indicates that the large majority of suppliers have a negligible dependence with respect to the frozen-vegetable industry and can rely on a large customer base elsewhere. However, 130 suppliers depend for more than 30% of their business on the 18 producers (this percentage even exceeds 50% for 81 of them). The deliveries of the 130 companies represent on average 42% of their overall annual turnover.

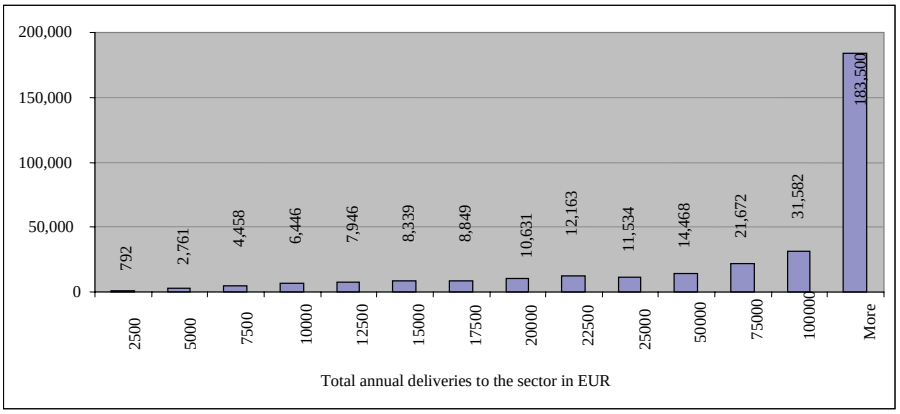

Figure 4. *Average annual deliveries per client (2000)*

Suppliers' dependence grows as their annual deliveries to the sector increase. As the significance of large-supplier classes increases, so does their dependence vis-à-vis the frozen-vegetable industry. However, this dependence is mutual in the sense that the frozen-vegetable producers also become more dependent on the most important suppliers. This means that the risk involved in opportunistic behaviour increases as transaction volumes rise. It is hardly surprising, therefore, that the frozen-vegetable producers have started to organize their transactions with these suppliers in order to minimize this risk by acting at cluster level.

Figure 6 indicates that this group of most independent suppliers nevertheless represents the largest share of the total annual deliveries: € 104 million or 35% of the annual overall deliveries to the sector. We also note that the value of the annual deliveries initially decreases as the level of dependence increases, while at the right-hand side of the graph in Figure 6, there is a small increase because of the large volumes that are sold by the categories of very dependent suppliers. This is as could be expected, in the light of our earlier finding that the largest suppliers are also relatively more dependent on the sector.

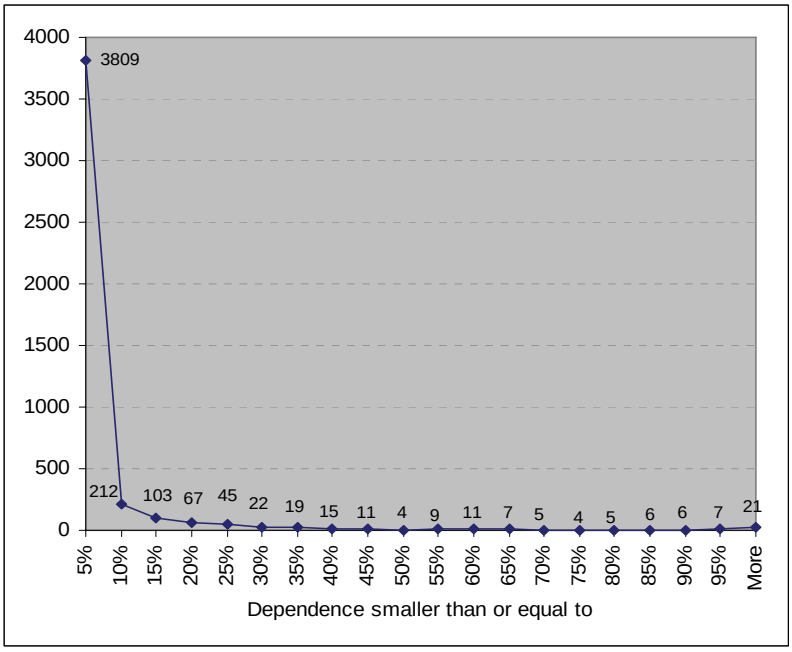

Figure 5. *Dependence of suppliers*

The distribution of the degrees of dependence is important because it allows us to estimate the overall dependence of the suppliers on the frozen-vegetable producers and to assess the indirect effects that are realized in the supplying industries[2]. Because the analysis of the frozen-vegetable sector was a test project, the impact analysis was limited to two levels, i.e. the first-level suppliers and their suppliers.

Many of the first-level suppliers are agricultural companies, which together represent 46% of all suppliers. The value of the deliveries is divided roughly equally among the three main supply sectors, i.e. agriculture, the food industry and the wholesale sector (each ca 23%). There are fewer than 70 second-level suppliers that depend indirectly (via the first level) on the 18 companies for more than 30% of their turnover. More than half of them belong to the agriculture-related sectors.

This information about supply relationships can be used to calculate indirect employment effects. Indirect employment in the frozen-vegetable sector is calculated as the employment in supplying firms multiplied by their dependence rate on the 18 producers. In this way, we get a rough estimation of the size of the frozen-vegetable cluster. Preliminary estimates of the indirect employment figures indicate that 1740 jobs are directly dependent on the economic activity in the frozen-vegetable sector. Nine out of ten of these indirect jobs can be found in nine sectors: agriculture (8.3% of indirect employment), manufacturing of food and drinks (8.4%), paper and cardboard industry (4.6%), manufacturing of metal products (6.1%), manufacturing of machines, equipment and tools (10.7%), construction (6.6%), wholesale and trade (9.0%), transport (6.0%) and business services (29.1%).

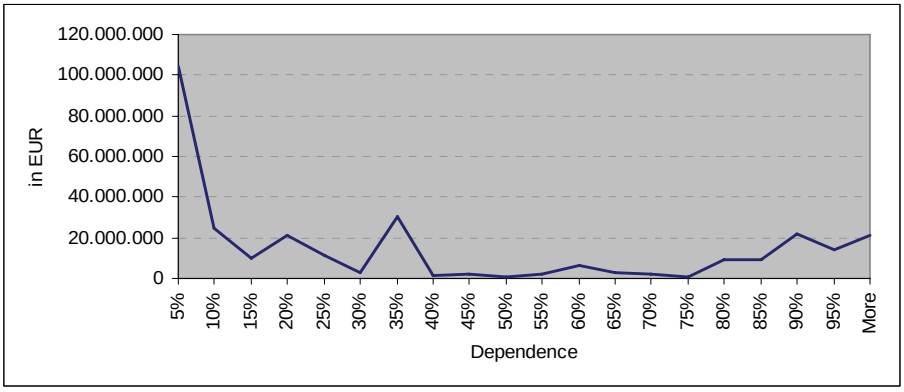

Figure 6. *Amount of annual deliveries according to dependence (in EUR)*

Geographical characteristics

Clusters are often characterized by a geographic concentration of suppliers. We divided the suppliers on the basis of their postcode, and then aggregated the sales volumes and number of companies for each area. For each of these aggregates we calculated a moving geographic average resulting into more homogeneous results compared to the ones based on raw data[3]. The outcome gives us an idea about the geographical concentration of domestic suppliers. Figure 7 illustrates the connection between the frozen-vegetable producers and the supplying vegetable growers (all first-level suppliers) per municipality. There is clearly a strong geographical concentration in West-Flanders, with a nucleus around Roeselare. There is another but much smaller cluster in Haspengouw and the province of Liège (right-hand side of Figure 7). This type of geographical concentration is usually the result of a historical development. In addition, we get similar results when the geographical concentration of the supplying vegetable growers is based on the value of their deliveries to the frozen-vegetable producers. As a result, we can conclude that the West-Flemish cluster is supplied by numerous small suppliers located in the immediate vicinity.

In summary, we can state that in a majority of the cases suppliers are relatively independent of the frozen-vegetable industry. In contrast, unlike the large majority of suppliers, a relatively limited number of companies are very dependent on the frozen-vegetable sector. The dependence of some large suppliers (> € 100,000 class) is relatively high, with an average dependence of over 20%. However, these suppliers are also very important for the frozen-vegetable producers, which implies that the contractual dependence is mutual.

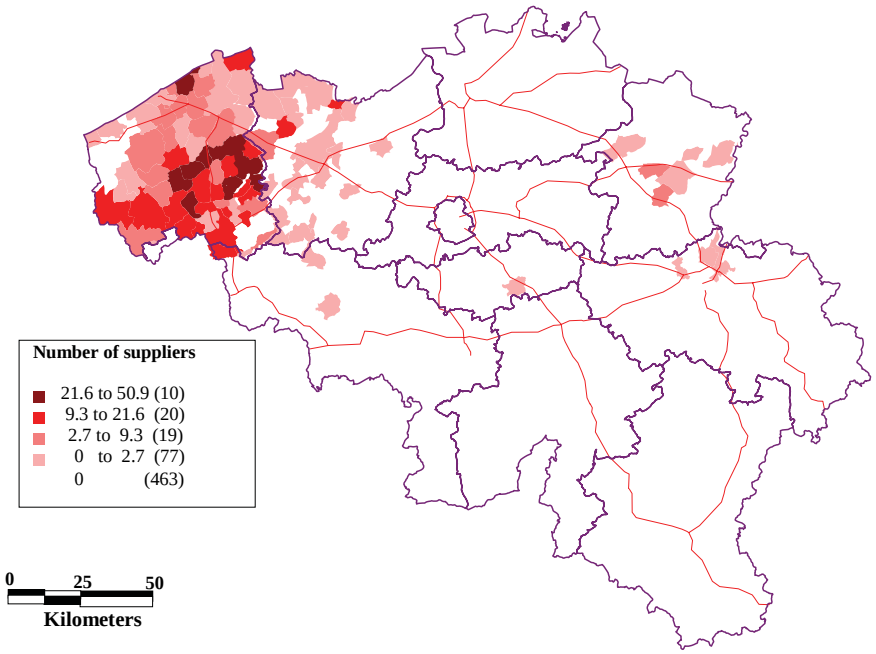

Figure 7. *Geographical concentration of first-level suppliers in vegetable cultivation on the basis of the number of suppliers*

CLUSTER ANALYSIS: 'FLANDERS VEGETABLE VALLEY'

In the previous section we have conducted a quantitative analysis of the transactions between the frozen-vegetable industry and the various suppliers. In this section we attempt to understand the dynamics of the cluster that explain the competitive strength of the 18 frozen-vegetable producers. For that purpose, we complement the quantitative analysis of the previous section with detailed qualitative insights how the most important suppliers are closely connected to the frozen-vegetable producers in the value chain.

The concept of clustering

Clusters are defined as "economic networks of strongly interdependent firms linked in a value-adding production chain. In some cases, clusters encompass strategic alliances with agents in the knowledge infrastructure, such as research institutes, universities, engineering companies and consultancy firms" (OECD 1999). This network formation usually takes place within a certain region and it generates a sustainable competitive advantage for companies that are involved. A combination of competition and cooperation creates a variety of interdependencies between the actors, resulting in a collective production advantage[4]. Economic clusters are to a large extent a 'spontaneous' market phenomenon. In contrast, 'cluster initiatives' are designed specifically to reinforce cluster benefits by setting up various types of 'organized' cooperation. A cluster policy can stimulate regional competitive advantages by supporting cluster initiatives because they offer a valuable contribution to a shared perception of the benefits of and barriers to clustering economic activities. An active cluster distinguishes itself through 'active channels' that turn the cluster not only into a transaction network, but also into a social production system (Rosenfeld 1997). In other words, the goal of a cluster analysis is to map this economic and social network formation.

In practice, cluster policy is different from its academic interpretation. On the one hand, researchers view clusters as fairly important economic complexes, whereas policymakers currently tend to emphasize relatively small networks, often organized around a specific enterprise or a narrowly defined industry branch. The discrepancy between theory and practice has a number of antecedents. First, economic policy has focused heavily in the past on macroeconomics. This implies that there is a strong inclination to base cluster policy on the existing macroeconomic policy instruments such as subsidies, guarantees, regulation, etc., whereas at the appropriate meso-economic level, at which clusters are defined, a more structural approach is needed. Second, the existence of clusters often remains undetected until one of the links in the chain experiences difficulties. Existing measuring tools often fail to bring existing clusters to the surface.

Both academics and policymakers are nowadays convinced, however, that a modern cluster policy should be disconnected from a traditional subsidy policy. On the contrary, the emphasis should be on generating innovations for new processes, products and services in order to reinforce the knowledge exchange and cooperation among cluster members, with the government acting as 'facilitator' in a multi-actor environment (e.g., Debackere and De Backer 1999; Capron and Cincera 1998; Larosse et al. 2000). The role of government as facilitator can only be realized insofar as policymakers understand the existing economic networks and their role in creating economic growth.

The business chain of the frozen-vegetable industry

The frozen-vegetable cluster is highly integrated via contract vegetable cultivation and the automation of the production chain. We will describe the various types of economic actors to improve our understanding of the 'interplay' between these

different actors within the cluster. The main supplying industries that depend on the sales of the frozen-vegetable industry are sectors such as wholesale, vegetable cultivation, transport, leasing, market research and other service providers. In addition, remuneration workers are also closely connected to the frozen-vegetable sector.

The various actors in the business chain

Vegetable growers
To a large extent the raw materials for the frozen-vegetable industry are produced locally by the vegetable growers, who often also service the fresh-vegetable market (via auctions). Vegetable cultivation is contract-based.

Wholesale
The buying and selling of frozen vegetables is carried out by companies that are linked to the producers.

Equipment goods
There is a close cooperation with local suppliers of critical equipment, especially in the area of cooling technology, where proximity is of the utmost importance.

Frozen-vegetable producers
The producers are involved in processing, freezing, packaging, storage and sales, and as such they are highly integrated companies. Outsourcing and expansion of partnerships with other production companies are practices that have not been widely adopted in the classic freezing process of raw vegetables, but those practices are becoming increasingly common in the case of more diversified products (expansion of the product range and new products, e.g., meat/fish).

Logistics
The sector uses specialised transporters and stocking facilities. Often, these are managed by the producers. But there are also suppliers of value-added logistical services.

Customers
Frozen vegetables find their way to the catering sector (kitchens of hospitals, hotels and restaurants), the retail sector (private labels) and the food industry (e.g. pizza and other preparations); each represents roughly one third in sales.

Consumers
The changing consumption habits of the end-user determine the market dynamics.

Environment
The entire business chain is in turn embedded in an ecological cycle (input: groundwater and process water; output: organic-waste flows and water usage.)

Cluster analysis

The descriptive analysis of the sector and the business chain are the ingredients for the analysis of the cluster 'Flanders Vegetable Valley'. An overview is presented in Figure 8.

The core of the cluster: the producers of frozen vegetables

The cluster has originated from the frozen-vegetable producers as an independent link between vegetable growers and the large-scale distribution. The development of the sector is a typical example of the kind of 'autonomous industrialization' that is characteristic of the economy in West-Flanders. There are a limited number of companies of which the entrepreneurs are connected through family ties and capital investment. As a result, there are also financial ties and group structures between some of the companies. Another characteristic – as is the case in other sectors in the region – is the fierce competition between the local companies and the use of a 'copycat' strategy. The development of the frozen-vegetable clusters is a nice illustration of Porter's cluster concept.

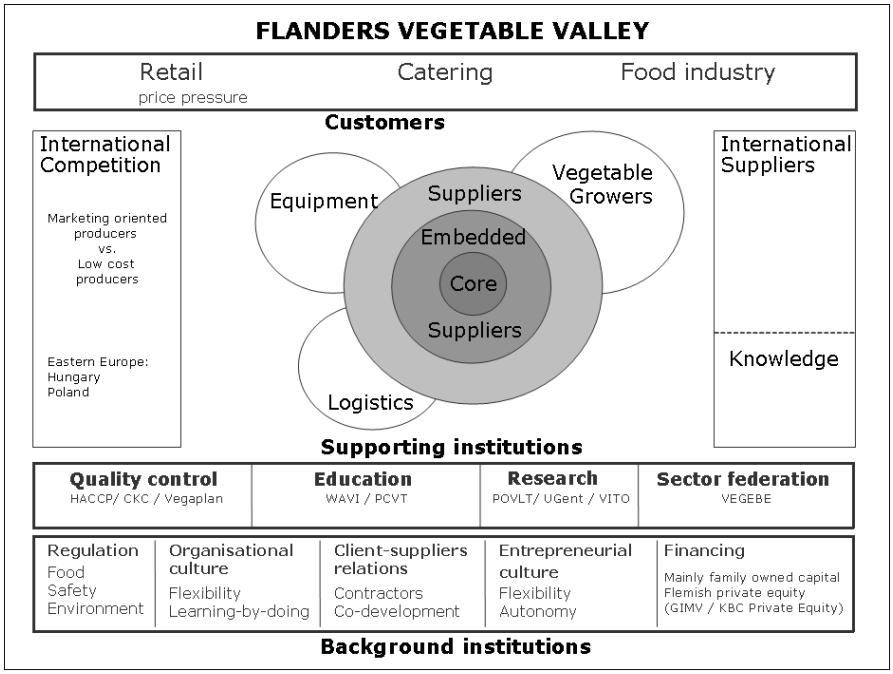

Figure 8. *Flanders Vegetable Valley*

In 2002, the combined turnover of the West-Flemish frozen-vegetable producers was € 840 million. In 2003, they produced 795,000 metric tons of an overall European production of 2 million metric tons. The frozen-vegetable sector in

Flanders started only 25 years ago, currently employs 2,260 people (according to the annual accounts) and indirectly accounts for an indirect job creation of 1,740 jobs within the first-level suppliers (see above). The total direct and indirect employment can be estimated at 5,000 jobs. At the turn of the century, the sector has invested heavily in automation and the average solvability is weak (7%). After a long period of expansion the industry is entering a maturity phase, which renders the existing fragmentation in the sector untenable. This is why industry experts expect a phase of consolidation and diversification in which the configuration and dynamics of the frozen-vegetable sector are likely to change. Hence, it is crucial to get a better understanding of the current cluster dynamics and the pressure for change the cluster is facing. Within the classic definition the sector is anything but innovative: not a single patent has been granted and investments in licences represent a mere 0.25% of the added value realized. Moreover, training of personnel is not impressive with 7.2 hours per year.

Although the frozen-vegetable sector is not R&D-intensive, the companies are very innovative within a broader perspective. As within other small family firms the generation and acquisition of knowledge take place in a very informal manner. People learn their skills on the job, which implies that little has to be spent on formal R&D expenditures. The driving force behind the technological progress is provided by the competitive 'action-reaction' dynamics between the local competitors when they implement new production techniques and market-driven innovations. Process innovation (automation) is an important competitive driver. In order to cope with local and international price competition and to compensate for the higher transport and labour costs, the frozen-vegetable producers have invested heavily in automation, in cooperation with – often local – suppliers. This has also resulted in important spill-overs. A supplier like SKT was involved in the early stages of the co-development of the frozen-vegetable sector in Flanders. Product innovation is a strong driver of the diversification strategy, enabling the companies to exploit niche markets that offer a higher growth potential and higher profit margins (e.g. bio-vegetables, fruit, herbs, exotic vegetables and prefab meals). This is done in a professional manner by a number of frozen-vegetable producers. The organizational innovation is also critical to manage successfully the increasing professionalism and internationalization of the business. Moreover, the way the companies operate is changing: they now also play the role of distributor and processor of imported, half-fabricated products. Finally, cooperation with knowledge institutes does not yet take place in a systematic way, but its importance is growing rapidly.

The companies within the cluster derive their competitive advantage from industry-specific expertise developed from the interaction between the companies within a cluster that has sufficient critical mass to translate local benefits into a source of collective productivity gains. For the frozen-vegetable industry these gains are:

- a tradition of quality-oriented intensive vegetable cultivation, in an area characterized by favourable climate and soil conditions;
- flexibility and international focus of local entrepreneurs in family-owned businesses;

- negotiation of prices and implementation of common quality standards through a collective consultation model between growers and frozen-vegetable producers;
- central location vis-à-vis markets and excellent transport connections;
- ongoing technological improvements as a result of fierce price competition within the cluster and of relatively high labour costs in the region;
- high level of innovativeness within the sector, spurred by mutual competition and imitation.

In recent decades, the frozen-vegetable sector has witnessed a strong international growth. Thanks to this international success, the acreage for vegetable cultivation in Flanders has doubled over a period of 20 years. However, after years of growth, the market is now saturated. For the first time, production restrictions have been discussed to reduce excess supply. Demand is shifting towards new forms of convenience food/ready-to-eat meals (pre-cooked; combined with other ingredients). Moreover, new competitors have emerged in Eastern Europe. Thus, the industry enters a phase of maturity at a time when supply is still highly fragmented (unlike the canned-food sector with 3 major players). The weakened growth in combination with the pressure on prices will lead to consolidation within the sector. Some companies decide to diversify in other product segments.

Industry experts expect the structure and dynamics of the frozen-vegetable sector to change. So far, there is no consolidation (M&A) between the West-Flemish companies. Some of them are reinforcing their international position by acquiring foreign competitors in Southern and Eastern Europe. This will influence existing cluster dynamics and the underlying driving factors. Therefore, we can expect that the existing cluster will be restructured. Policymakers should definitely take these dynamics into account when redefining a cluster policy.

Supplying and supporting sectors

In the previous section we have carried out a quantitative examination of the relationships between the suppliers and the Flemish frozen-vegetable sector. In 2000, the total number of first-level suppliers was 4,388. In terms of volume and dependence, most of them were relatively insignificant: they have straightforward market transactions that do not warrant closer inspection within the context of a cluster analysis. However, 299 industrial suppliers annually sold more than € 100,000 to the 18 frozen-vegetable producers; together they are responsible for 82% of the total deliveries to the sector. Therefore, we make a clear distinction between ‘occasional’ and ‘embedded’ suppliers. The 299 most important suppliers can be considered ‘embedded’ suppliers: 81 of them depend on the frozen-vegetable sector for more than 50% of their turnover. In addition, there are 70 second-level suppliers that depend on these first-level suppliers for at least 30% of their turnover.

There is a strong mutual dependence between 20% of these 299 suppliers and the frozen-vegetable producers. We know about these types of transactions that the costs involved in opportunistic behaviour can be very high (Williamson 1975; 1983; 1985). This problem even becomes more serious when the supplier has to make specific investments that have no market value beyond the transaction with the frozen-vegetable sector. Furthermore, ‘embedded’ suppliers have to synchronize

their strategy with that of the frozen-vegetable producers: for example, what are the opportunities for 'embedded' suppliers to match the internationalization process of the producers? The group of 'embedded' suppliers consists of companies from various sectors: wholesalers, growers that supply directly, suppliers of equipment, transport companies, leasing, market research and other services. Furthermore, remuneration employees who invest in harvesting machinery are also highly dependent on the frozen-vegetable producers. We address them one by one in the next section.

Vegetable growers. Contract cultivation is the dominant method of producing frozen vegetables, with prices, quantities and quality being determined beforehand between the growers and the frozen-vegetable industry. The vegetable growers in turn use inputs like seeds and pesticides, but also machines for planting and harvesting. In other words, they are an important link in the cluster. They depend on the cluster to the extent that there is no alternative market for the cultivated vegetables.

Since the decline of flax cultivation, vegetable cultivation has been one of the most dynamic agricultural activities in West-Flanders. However, there are various categories of vegetable growers[5]:

- Farmers with a relatively large acreage at their disposal who, next to traditional crops (grain, sugar beet, etc.), also grow vegetables for industrial processing (labour-extensive), like peas, beans, spinach and carrots. If their activities include livestock, their level of dependence on the sector may be very low. However, in terms of crop rotation those crops are indispensable.
- Vegetable growers who grow vegetables on a more limited acreage, supplying to both the frozen-vegetable industry and the fresh-vegetable market (REO auction). These are primarily labour-intensive crops like leek, cauliflower, celery, etc. Depending on price fluctuations, the dependence of this group on the frozen-vegetable sector may vary. Because of their small acreage, this group of growers is threatened by a lack of contracts in a stagnating market.
- Vegetable growers who focus almost exclusively on frozen vegetables (larger companies) and who combine labour-intensive and labour-extensive crops. These companies are highly dependent on the frozen-vegetable sector, and for many of them the dependence increased due to the financial burden of earlier investments or expansions.

Some 3,200 vegetable growers are members of the REO auction, the cooperative vegetable auction/market in Roeselare. About 2,500 vegetable growers (whether or not they are member of REO) supply to the frozen-vegetable industry. In Flanders, they annually produce 750,000 metric tons of raw vegetables, with a total production value of € 150 million (in 2000). Most of these vegetables are bought by the frozen-vegetable sector (primarily cauliflower, Brussels sprouts, green peas, green beans, leek and spinach). The increasing demand in the frozen-vegetable industry has been responsible for the doubling of the arable land since 1980. Thanks to technological progress, planting and harvesting machines could be deployed profitably on smaller farms, while maintaining the quality that is so typical for traditional intensive vegetable cultivation.

The vegetable growers are in a relatively weak negotiation position vis-à-vis the frozen-vegetable producers because they are comparatively small and fragmented. In addition, it is a tradition on the part of the producers to make collective deals about prices and volumes. The growers have hardly any bargaining power. The recent stagnation in the market pushes the growers more and more into the role of 'price taker', which leads to growing tensions. However, the raw-vegetable cultivation in West-Flanders is an important factor in creating the competitive edge of the frozen-vegetable producers. The small scale of the agricultural companies and the tradition of high-quality products are essential to the supply process. Furthermore, weather conditions play a crucial role in the relationship between growers and companies: a bad harvest could lead to a bidding war between the producers in a scramble for the available vegetables. A good harvest could lead to a downward price spiral, seriously affecting the income of the growers. Therefore, the sector is used to work with contract deals that predetermine prices and volumes. When there is a bad harvest, there will be no bidding war. When there is a good harvest, producers pay the predetermined price and buy additional vegetables (at lower prices), allowing the growers to benefit from the good harvest rather than presenting them with a disastrous price war. So far, the cooperative agricultural organizations of the Belgian Farmer's Union (Boerenbond) has not formally been involved in the frozen-vegetable sector, unlike in the fresh-vegetable sector, but they will not hesitate to form a strong market organization in case contracting is not properly functioning.

Contract deals are not only a guarantee against transaction risks. It is also the way in which companies ensure that new types of seeds are introduced and that research is conducted into improved agricultural techniques. Information and training are given to farmers. The role these learning mechanisms play in the gradual reinforcement of the international competitiveness of the cluster should not be underestimated.

Suppliers of equipment. For the automation of production and the development of new products and processes, it is necessary to cooperate closely with equipment installers and machine builders. A first group consists of the builders of pre-processing installations (washing, cutting and blanching). Cooling techniques of freezing rooms and tunnels also play an important role. SKT, a supplier of cooling equipment, developed new freezing techniques together with the frozen-vegetable producers, and became an international specialist in the construction of cooling and freezing rooms. Thanks to the know-how it acquired over time in collaboration with the frozen-vegetable producers it was able to diversify into indoor ski slopes as a new niche market. This evolution also illustrates the importance of spill-overs of successful clusters toward the development of new activities and the cross-pollination of related clusters. Cooling and freezing technology can support various sub-sectors in the food industry. The same holds for other technologies such as air-drying systems, inspection systems and sorting machines, automation, etc.

The negotiation power of suppliers vis-à-vis frozen-vegetable producers varies from sector to sector. The frozen-vegetable producers are in a relatively comfortable position when it comes to the procurement of relatively simple products and services. However, the situation changes when a supplier sells a unique product that

may help reduce the costs of frozen vegetables or may increase their value. In that case, the frozen-vegetable producers try to limit the power of the supplier by encouraging local equipment manufacturers to imitate the innovation and to manufacture similar installations. The purchase price of different types of equipment drops quickly once these new manufacturers enter the market.

Logistics. Because the cooling chain must not be broken, frozen-vegetable producers cooperate closely with specialized logistics companies for transport and storage. Because of their strategic role these companies are often 'embedded' in the processing companies. Packaging is integrated into the production companies. However, diversification in the frozen-vegetable sector has created room for value-added logistics in this area. Packaging company Barias, for instance, benefits from the lack of flexibility associated with high-volume packaging by repackaging the products in smaller volumes using independent contractors.

Services. The frozen-vegetable producers not only use their own sales apparatus to commercialize their products, but they also make selective use of the sales infrastructure of the retail sector. The continuous growth and internationalization also urged many companies to professionalize their management. As a result, marketing research agencies and management consultants are called in to manage the change process.

Customers. Large-scale distribution, the food sector and the catering sector are the three major customer types. The large distributors are the largest individual customers and they have considerable negotiation power: the Flemish frozen-vegetable producers usually supply to them under 'private label'. The increasing concentration of purchasing power in the large-scale retail increases the pressure on the profit margins of the frozen-vegetable producers. In the food sector the customers are companies with brand names like Iglo and food companies that process vegetables into ready-made dishes like pizzas. The frozen-vegetable producers are trying to enter this market segment, which is characterized by high margins and strong growth. A third important customer sector is the catering sector, with a variety of customers exploiting large kitchens (e.g. hospitals, hotels and restaurants).

International competition

Unilever's brand Iglo with a very strong marketing organization is the European number one for frozen vegetables. However, recently, Unilever reached an agreement to sell the majority of its European frozen-food business, including the frozen vegetables of Iglo, to Permira Funds, a leading European-based private-equity firm. Bonduelle is the second largest European producer of frozen vegetables. This diversified vegetable specialist gets most of its revenues from its canned-food business (market leader in many countries, also in Belgium after its take-over of Marie Thumas) and is increasingly active in the fresh-vegetable market.

The Flemish frozen-vegetable producers position themselves primarily as 'processors' and they usually do not invest in the development of brands of their own. The other Western-European producers are smaller companies, several of which have been taken over by their Flemish competitors. In the past, they have been protected primarily through their national market structures. Producers in Southern Europe can only grow internationally via the sales of their specialities (paprika, broccoli, maize). These local producers abroad are not posing a competitive threat but are rather take-over candidates.

Eastern Europe is a growing market with a number of strong producers. In Poland, the old regime invested in deep-freeze processing at an early stage. The most important Eastern-European competitor is Globus in Hungary (which has entered into an alliance with Belgian Pinguin). The Eastern-European companies are very cost-efficient, although they are lagging behind in terms of investments in new technology. The biggest challenge for Western Europe is the flight of Western-European producers, who can apply their quality-oriented production at a much larger scale and at much lower costs in Eastern Europe. Although Eastern-European competition has cheap labour costs, climate conditions are less favourable than in Flanders. From a business management point of view these companies do not have a sustainable competitive advantage because of a lack of investments in the past: when they want to innovate, depreciations (and consequently also costs) will rise dramatically. This situation offers an opportunity for the Flemish producers who want to expand through alliances with and take-overs of local producers in these countries. As a result, some of the production of frozen vegetables will shift towards Eastern Europe. However, packaging and distribution will remain in Western Europe, because these activities have to take place close to the end-customer. In this constellation the West-Flemish producers will need to compete even more on the basis of their locally-embedded competitive advantages and quality systems.

Supporting institutions

Companies never work in an institutional vacuum. On the contrary, the positive cluster dynamics is the outcome of the existence of specific institutions and the way they operate.

Sector federation

VeGeBe was founded in 1980, and since 2001 it not only includes the frozen-vegetable producers, but also 12 trading houses active in the industrial vegetable sector, as well as the two remaining canned-vegetable producers. In 2001, VeGeBe was instrumental in setting up the European Frozen-Vegetables Industry – an organization of European frozen-vegetable producers at the European level. The sector federation plays a crucial role in the market organization through mutual price agreements and negotiation with agricultural organizations. The system of contract cultivation enables the producers to reach an agreement not only on pricing, but also on weight, quality and delivery date. The excellent organization of quality control (production according to quality rules) is a cornerstone of Flemish competitiveness and an important strategic objective of VeGeBe. The sector federation safeguards

the balance between cooperation and competition in the cluster; companies have to cooperate and compete at the same time ('coopetition') and this continuous tension is balanced by VeGeBe through its consultation and arbitration in cases of conflict.

Quality control

The cooperation between the processing industry, the REO-auction, specialized wholesalers and growers is at its strongest in the organization of quality control. Since 1997 all producers are equipped with a system for quality monitoring (HACCP). In 2002, VeGeBe set up a Centre for Quality Control (CKC) as an independent monitoring body in charge of certification and the implementation of the agreed standards. Recently, vegetable cultivation has also been included in Vegaplan, the umbrella system of auto-monitoring for the supervision of the implementation of quality regulations, supervised by the Federal Food Agency. The REO auction has adopted the EurepGAP company label, which provides an extensive quality control. It invested heavily in a high-tech system of tracking and tracing via barcodes, flexible cooling spaces and radiofrequency-guided forklifts to modernize its warehouses.

Education

In West-Flanders there is specialized agricultural education and training: there are eight schools for secondary agricultural/horticultural education. Finally, there is a 'Practice Centre for Agriculture and Horticulture' (PCVT) and a 'West-Flemish Agricultural Training Institute' (WAVI).

Research

Although all companies have a quality-control department to monitor product characteristics, Pinguin is the only company with a formal R&D department that primarily focuses on testing new products and mixtures. Research infrastructure was built gradually. In 1956, the Provincial Research and Information Centre for Agriculture and Horticulture (POVLT) was founded near Roeselare. This organization conducts research for the industry with regard to vegetable cultivation. There are occasional contacts between the companies and research institutes. These contacts usually take the form of bilateral deals between individual companies and research institutes. With the start of the VLAG project (Flemish Technological Advice Centre for the Vegetable-Processing Sector) in 2004, a collective structure was set up for the first time. This centre is supported by IWT (Institute for the Promotion of Innovation by Science and Technology in Flanders) and gives technological advice about preservation technology.

However, there is a wide range of research into preservation techniques, flavour, nutritional value and quality at different research institutes in and around Belgium, but the frozen-vegetable industry has not yet used this innovation sources sufficiently. The centre of excellence 'Flanders Food', which is currently being set up, may play an important part in realizing this objective. Another challenge in which research can play a special role is the processing of biomass or residual waste

into energy. After all, energy consumption by the sector is considerable (about 4% of the added value), while at the same time there are huge costs involved in waste treatment.

Socio-cultural embeddedness of the cluster

The formation of this cluster with the frozen-vegetable industry as its nucleus cannot be separated from the economic and socio-cultural development of South and Central West-Flanders (Vanhaverbeke 2001; Musyck 1995). The entrepreneurial culture is cultivated within the local social environment. The creative entrepreneurial tradition of the flax industry, the continuous transformation of the economy, abandoning old industries in favour of new ones, family-owned SMEs, intensive competition, etc. are important characteristics of the local economy. The emergence and growth of the frozen-vegetable cluster is a typical example of this endogenous growth of the economy. Other sectors in the region show a similar development: typical examples are the textile industry (tufted carpets), wood and furniture (chipboard and laminate), the metal industry and construction.

The competitive advantages of companies in the frozen-vegetable cluster in West-Flanders can be attributed to the typical SME culture in the region. The many relatively small family-owned companies have a flat organizational culture, which makes it possible to respond quickly and efficiently to changes in the market. The high level of flexibility and the cost-efficiency (due to the absence of unnecessary overhead) ensure that the sector can compete in a way that is hard to imitate by foreign companies. The flexibility also ensures that companies reach a break-even point at smaller volumes compared to their foreign competitors. For a sector like the frozen-vegetable sector, where variety and the combination of various products are important, this may play a crucial role in explaining the competitiveness.

The labour market is also an important factor in the local socioeconomic environment in which the frozen-vegetable sector operates. Due to the many industrial SMEs in the region there has always been a considerable and high-quality supply of skilled personnel. For decades the relationship between technical education and the local business community has played an important role. Furthermore, the regional concentration of frozen-vegetable producers has generated an extensive network of employees with industry-specific knowledge. This offers an advantage that should not be underestimated: expertise is built quickly through interaction between experienced and new employees; it spreads quickly through labour migration between companies and social interaction between employees. Nevertheless, the region currently faces a structural shortage of skilled personnel, which becomes painfully apparent in times of economic prosperity. In addition, there are growing problems in realizing a smooth transition between technical education at schools and the (technical) skills that are required by the business community.

Part of the success of the sector is achieved through the presence of family capital. This private financing offers a level of autonomy that is vitally important in traditional industrial sectors where a sustained commitment – especially during economic downturns – is crucial to build and maintain a sustainable competitive

advantage. However, as the sector is heading for stagnating demand and internationalization has become a precondition for survival, family capital is in most cases inadequate and new financial injections are indispensable. Next to an IPO (case of Pinguin), the entry of private-equity funds with a longer investment horizon like GIMV (in Dujardin/Unifrost) and KBC Private Equity (in Pinguin) might offer a possibility to attract new, external capital. The search for new capital goes hand in hand with more professional management approaches as external financiers tend to invest only in well-managed companies. Moreover, consolidation by mergers and acquisitions is an obvious route to restructure the industry.

Cluster dynamics

The analysis of the effects and dynamics of the frozen-vegetable cluster shows us that the relationships with local vegetables suppliers play an important role. Growing cost pressure, due to buying power of large-scale retailers, forces frozen-vegetable producers to cut costs: they attempt to pass the buck to the suppliers. In recent years this has led to tensions with the growers during the contract negotiations. Another outcome of the increasing cost pressure is that certain producers are looking for locations where products can be produced more cheaply. Eastern Europe offers opportunities in that respect. Part of the production could be moved to the EU's new member states. However, various activities, like preparation and packaging, will usually take place close to the consumer (the north of Western Europe). Packaging imported vegetables locally will be more and more important. The advantages of cost-reducing investments outside the cluster will always have to be weighted against cluster advantages. Nevertheless, it is beyond doubt that the search for cost-reducing investments puts pressure on the cohesion of the West-Flemish cluster. The main challenge is to find new institutional forms of cooperation in which a shared future can be built within the cluster.

The government also plays a clear role in the cluster dynamics. Currently, government regulation plays a restrictive role through more stringent environmental demands (primarily groundwater-related issues) and food safety requirements. Environmental demands increase the costs, which, in view of fierce international competition, is tough on the sector. This might accelerate the delocalization of certain activities. However, food safety requirements can also offer a competitive advantage to the frozen-vegetable producers in Flanders, provided they is validated in the purchasing policy of the companies further down the business chain and especially if they will be imposed on a European scale. Finally, there are problems with regard to spatial planning. Due to the agricultural nature of the sector, many companies originated in the countryside, which makes them part of rural areas. The current restrictive spatial-planning policy makes it difficult for them to expand, and they face more stringent regulations than firms located in industrial areas. Furthermore, in the region there is a shortage of industrial sites, which makes it hard to establish new production plants.

The economic 'health' and future development of the frozen-vegetable cluster is, therefore, partly determined by the decisions of policymakers. There is a growing need to develop a cluster policy in which government helps to create the

environmental conditions favouring the strategic cooperation between cluster members (e.g., the stimulation of technological and strategic innovations in the business chain). So far, policymakers tended to focus exclusively on technology-based product and process innovations. However, in order to capture the potential benefits of proximity one has also to think seriously about organizational innovations (e.g., in the area of integrated coordination of harvesting and processing) that would lead to the creation of value networks in the cluster, realising in this way the full potential of value-creating and value-capturing strategies.

CONCLUSION

The analysis of the factors that determine the international competitiveness of the West-Flemish frozen-vegetable cluster shows that local factors remain important to explain the competitive position of a company, despite the increasing globalization of the economy. We also investigated how specific environmental factors that seem to be disadvantages at first sight can increase a company's competitive advantage in the long run. High labour costs and shortage of skilled personnel in the sector led to further automation, which resulted into increased scale economies and cost-efficiency. The limited local demand spurred local entrepreneurs to internationalize. West-Flemish frozen-vegetable producers became very flexible producers that could cope efficiently with tough and diversified foreign demands. Additionally, stringent legislation and regulation could force companies to focus more on foreign growth. Innovations in processes, products, organization and markets are a constant requirement to stay competitive.

The competitive advantage of the frozen-vegetable cluster results from the close interaction between frozen-vegetable producers and other actors within the local socioeconomic environment. A basic condition for the vitality of the cluster is the mixture of cooperation (in purchasing, learning, R&D) and competition (in sales), in, respectively, the head and the tail of the business chain. The intense local competition among the frozen-vegetable companies lies at the basis of the strong expansion. At the same time, they profit jointly from the cluster dynamics and the resulting improvement in competitiveness. In this respect, the relation with the vegetable growers and the cooperation with technology suppliers (e.g., cooling) were particularly important in building competitive leadership. A small minority of suppliers, responsible for 82% of all deliveries, could be considered embedded suppliers with a mutual dependence between them and the frozen-vegetable companies. This is also the case on a broader scale with the 2,500 growers who supply the frozen-vegetable producers. The vegetable growers organized themselves better through the establishment of cooperative vegetable auctions. These close supplier relationships form the foundation of 'Flanders Vegetable Valley'.

Due to the growing buying-power of large-scale distribution, the increasing environmental costs and the expansion of the EU, profit margins in the sector have come under considerable pressure in recent years. Frozen-vegetable producers try to reposition themselves in the changing market landscape and are putting pressure on their suppliers. The result of these recent developments is that the cluster may

disintegrate. The challenges the frozen-vegetable cluster faces illustrate that technological innovation is only one of the aspects of a bigger picture in which especially organizational and institutional innovations play a leading role. In short, monitoring the developments in the business chain between suppliers and customers/consumers, both in quantitative and in qualitative terms, is a source of strategic intelligence for new initiatives in cluster policy. The future of 'Flanders Vegetable Valley' depends on the strategic moves the different cluster players will take.

NOTES

[1] Acknowledgements: We are grateful to Mr. Van Gastel, Mr. Coppens and Mr. Troch (NBB) for providing the data about the frozen-vegetable producers–supplier relationships, and their valuable comments on an earlier publication (Vanhaverbeke and Larosse 2005). Any errors this chapter may contain are our responsibility.

[2] To calculate the indirect effects we use the experience of the NBB. In various NBB studies economic-impact analyses were conducted for a number of sectors, which clearly showed the importance of supply flows in determining the indirect effects (e.g. ,Coppens and Van Gastel 2003; Coppens and Vivet 2004).

[3] Deliveries of the surrounding municipalities within a radius of 10 kilometres are included in the calculation of the value of a particular municipality. The relative weight of neighbouring municipalities decreases with distance (Cabus and Vanhaverbeke 2003).

[4] At the beginning of the 20th century, Marshall introduced 'industrial agglomerations'. In the 1950s-1960s the common term was 'growth poles', in the 1970s 'industrial complexes' or 'clusters'. However, the concept of 'clusters' became really popular with the work of Porter (1990).

[5] Based on information from Mr. Meulemeester, consultant of the Boerenbond (BB).

REFERENCES

Cabus, P. and Vanhaverbeke, W., 2003. *Ruimtelijk-economische dynamiek in Vlaanderen: strategisch plan ruimtelijke economie*. Academia Press, Gent.

Capron, H. and Cincera, M., 1998. *The Flemish innovation system: an external viewpoint*. IWT, Brussels. IWT-Studies no. 28.

Coppens, F. and Van Gastel, G., 2003. *De autonijverheid in België: het belang van het toeleveringsnetwerk rond de assemblage van personenauto's*. National Bank of Belgium. National Bank of Belgium Working Paper no. 38.

Coppens, F. and Vivet, D., 2004. De ICT-nijverheid in België. *Economisch Tijdschrift* (1), 3-55.

Debackere, K. and De Backer, K., 1999. *Clusterbeleid: een innovatie instrument voor Vlaanderen? Reflecties op basis van een analyse van de automobielsector*. IWT, Brussel. IWT-Studies no. 21.

Larosse, J., Hantschel, R., Jacobs, D., et al., 2000. *Clusterbeleid als hefboom tot innovatie*. IWT, Brussel. IWT-Studies no. 30.

Musyck, B., 1993. *Autonomous industrialization in South-West Flanders*. University of Sussex, Brighton. PhD thesis

Musyck, B., 1995. Autonomous industrialization in South West Flanders (Belgium): continuity and transformation. *Regional Studies*, 29 (7), 619-633.

OECD, 1999. *Boosting innovation: the cluster approach*. OECD, Paris. OECD Proceedings. [http://www.edisonproject.info/files/BoostingInnovation.pdf]

Porter, M.E., 1990. *The competitive advantage of nations*. The Free Press, New York.

Rosenfeld, S.A., 1997. Bringing business clusters into the mainstream of economic development. *European Planning Studies*, 5 (1), 3-23.

Vanhaverbeke, W., 2000. *The tufted carpet industry in Belgium (A), nr. 300-094-1*. ECCH.

Vanhaverbeke, W. and Larosse, J., 2005. *Flanders Vegetable Valley: de Vlaamse diepvriesgroentesector als voorbeeld van een clusteranalyse*. IWT, Brussel. IWT-Studies no. 52. [http://www.iwt.be/downloads/publicaties/observatorium/obs52.pdf]

Vanhaverbeke, W.I.M., 2001. Realizing new regional core competencies: establishing a customer-oriented SME network. *Entrepreneurship & Regional Development*, 13 (2), 97-116.

Williamson, O.E., 1975. *Markets and hierarchies: analysis and antitrust implications: a study in the economics of internal organization*. Free Press, New York.

Williamson, O.E., 1983. Credible commitments: using hostages to support exchange. *The American Economic Review*, 73 (4), 519-540.

Williamson, O.E., 1985. *The economic institutions of capitalism: firms, markets, relational contracting*. Free Press, New York.