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Food Valley; on its way to be a proper cluster!?



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1. Introduction

According to policy aims of the European Union, the so called Lisbon agenda, it is essential for European countries to focus on a competitive and dynamic knowledge based economy (Featherstone and Raedelli, 2003). One of the main reasons behind this aim is the movement of 'mass production' to low-wage countries. For countries such as China, Thailand and India the low labor costs compared to Western countries are a competitive advantage. That is because the total costs per unit of output are lower; caused by the low labor expenses per unit (Frank, 2006). Therefore mass production based industries are of less interest for European entrepreneurs and policy makers to invest in. In order to cope with the reduction of industrial activity in general the Dutch government responded to the Lisbon Agenda by creating an Innovation Platform. The Ministry of Economic Affairs of the Netherlands is trying by the use of this platform to stimulate innovational power by investing in regional development and assuring that small knowledge intensive firms are able to grow and develop. The focus on these small firms is due to the widespread believe that small firms are the catalysts of economic development (Thurik, 2002 et al.).

In 2005 the outcomes of several studies of this Platform were partially used for the "Pieken in de Delta" (In English: "Peeks in the Delta") initiative. The main purpose is to stimulate specific regional economic activities. To realize this goal, of stimulating the regional economies, the Dutch government decided in the first place to focus on the removal of interfering regulations. These interfering regulations are in literature frequently described as 'red tape' (Cave, 2005), which implies excessive regulation that hampers action and the decision making process of firms within the scope of business development. A good example of red tape is the abundance of permits and regulations (building permit, sales permit, registration with the Chamber of Commerce etcetera) that are necessary to start a firm anywhere in the Netherlands. If the procedures could be bundled or be minimalized, this would induce firm start ups and business expansion.

However the most attention was paid to focusing regional policies to make use of region specific advantages. In order to attain the most optimal effect the Dutch government decided that local government could appoint geographic areas of special interest, so called 'peeks'. After careful evaluation the central government decided to invest in areas which were described as potential high-growth areas (Van Hoof, 2007). Food Valley can be seen as an important element within the "Pieken in de Delta" plan,

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because of the specific characteristics of this area. Later on in this paper there will be a focus and a closer analysis on what these characteristics are.

Besides "Pieken in de Delta" the Dutch Innovation Platform argued in 2006 that it was important for the Dutch government to invest in regional initiatives in order to induce the knowledge based economy (Innovatieplatform, 2006). Several other advising agencies such as the de Adviesraad voor Wetenschap en Technologie (In English: Advisory Council for Science and Technology Policy) and the Sociaal-Economische Raad (In English: The Social and Economic Council of the Netherlands) made publications where the regional role with respect to innovation was stressed.

The focus of the "Pieken in de Delta" is the enhancement of the regional economy by using the region specific advantages. This would be beneficial for the national economy because of the more optimal (regional) allocation of resources such as labor and capital. According to Van Hoof (2007) the Dutch government tried to use the regional advantages by creating several knowledge based institutions near to universities which, in theory would lead to cooperation and innovation.

This idea of the government to support knowledge based institutions is based upon the assumption that cooperation between firms leads the innovation and economies of scale. Because of the lessened focus on competition firms can use the available energy in developing their business in a more lean and efficient entity.

Besides innovation is beneficial on a macro scale, because it is a drivers behind regional and hence national economic development. Several researchers such as Porter (2000) and Saxenian (1994) acknowledge the role of mutual cooperation between firms as an economic driver.

As described is the focus of "Pieken in de Delta" on regions with a relevant geographic and economic interest. For example the area of Enschede was in the beginning of the 20th century an important area for the textile industry but is nowadays not able to compete on a (inter)national scale. So it does not fit in the aims of "Pieken in de Delta". This is different with the area near Wageningen. The Netherlands is internationally famous for its agricultural knowledge (Kraak and Oevering, 2003) and the 'ultimum summum' of this sector can be found close the Wageningen University.

This observation was also made by the government and therefore the area in Wageningen, combined with its surrounding municipalities was a anchor point in the "Pieken in de Delta" plan. The observation that this area is unique in the Netherlands for its knowledge intensive agricultural characteristic (such as the presence of the Wageningen University and the LEI institute) led to the ambitious goal of creating a

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world competing knowledge intensive agrifood / life science area. To support this ambition the name "Food Valley" was created. For the remainder of this thesis the name of Food Valley will be used.

The role of policy regarding clustering is evident due to the different institutions that are created in order to carry out innovation: for example 'Stichting Food Valley', which is used as a platform to link business initiatives and create additional business activity. In general do these institutions have the goal to induce the growth of the cluster and the creation of certain parameters that can be of positive effect on the embedded companies in the cluster. This thesis will almost not give attention regarding this phenomenon because that would lead to much to a description of policy and their activities. The main goal of the thesis is to give insight in the determinants of the formation and the (prospect of) growth of Food Valley.

The development of the Food Valley cluster seems to be interesting to monitor, there are lots of different characteristics that can lead to a successful cluster (Saxenian, 1996). For example a dominant public sector which is a reliable partner for private investors, knowledge (university) in the near vicinity and the accessibility of the region. When the number of involved firms is quite low (Kraak and Oevering, 2003), this seems not to be a good parameters for a cluster to be seen as successful. Given some of these characteristics the question rises if Food Valley can be seen as a cluster and how can this cluster be defined? Numerous theories have been formulated in order to describe clusters and their underlying processes (Castells and Hall, 1994). Famous examples such as Silicon Valley and Emilia Romagna have important places in economic theory (Bresnahan, 1991). The challenge is to formulate a theoretical framework based upon some renowned theories in order to research the situation in Food Valley.

The main question of this thesis therefore will be:

Can the cluster near Wageningen ("Food Valley") be considered as a proper cluster?

In order to be able to give an answer with respect to this question it is necessary to define what a cluster is and what the determinants are for a cluster to be proper. This will be discussed more closely in the theoretical part of this thesis.

To make it possible to give an analysis regarding the cluster concept, will this thesis primarily focuses its theoretical framework on the theories of a major contributor to the theoretical research with respect to clustering: Michael Porter. According to Martin and Sunley (2003), Michael Porter has achieved that the cluster concept is playing an

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important role in economic models, theories and policies. The main focus on Porters theory will be at the institutional and social causes of clustering. These factors have a so called path dependent character (Storper, 1997).

The theoretical part will also describe what the advantages of a cluster are. This matter is addressed, because it is possible to see certain tendencies for companies to have benefits from being closely involved with other companies or other institutions in a regional context. The description of the theory will end with the question: is a cluster makeable?! Which means that governments or other private initiatives are able or are not to create at almost any place and time the right characteristics for clusters to grow and to end up successful.

After the theoretical framework the methods used for the collection of data will be described. Using these methods will this hopefully result in comparable data and observations regarding Food Valley in order to answer the main question of this thesis. The setup will be a case study, it is important to look a specific characteristics of Food Valley and to compare these with general underlying theoretical concepts. Besides, to make a case analysis it is essential to compare certain regional characteristics with other similar cases. Due to the fact that there is a widespread belief that clusters are the most promising for economic and cultural development (Lambooy, 2005) there are numerous possibilities to evaluate clusters. However the theoretical framework based upon the research of Porter will be linked with the data.

The final part will be a conclusion that gives answer to the question posed earlier in this thesis and these will also be put in perspective relating the general theory and this specific case situation. Where it is possible this part of the thesis also discuss some recommendations that can be implemented in order to have in theory a more successful cluster.

The main contribution of this research will be that it provides additional insight in the cluster formation with respect to a specific case. The fact the there is chosen for a cluster which is not extensively researched, implies that the scientific scope can be broadened. With respect to the more empirical part of this thesis it is important to realize that the increase of the understanding of how certain factors influence the formation or the success of a clusters gives which can be used to create a more general framework regarding clusters. However it is essential to grasp the regional dimension of a cluster. There are in most cases specific characteristics that are unique for that specific region, so not necessarily these are described, but this thesis tries to describe the empirical regularities that can be derived from these observations.

2. Theoretical background

In this chapter there will be given a historical and theoretical overview of in general. The first subsection will address the definition of a cluster. The second subsection describes how the cluster concept developed in time. Three different scientific theories will be compared with each other, namely the Marshallian, the Neoclassical and the institutional point of view. The theory that Alfred Marshall developed in the, late, 19th century is seen as a starting point of scientific research regarding why firms which have a similar economic core business tend to group together (Amin, 2000). That is why this theory can be seen as an ideal starting point to analyze the 'cluster concept'. The Neoclassic point of view is the second theory that has a place in this thesis; according to Martin (2001) the Neoclassical theory was based upon rational choice models, where there was no place for social, cultural and institutional processes. This gives a complete other perspective on the question why clusters exist and develop. The third theory that is addressed is the 'institutional theory'. The foundations were largely developed in the eighties of the 20th century and has as a central point of view that institutional forces, such as the government, and other social, political and cultural forces are the pivot on which everything hinges (Piore and Sabel, 1984).

After this extensive description of the development over time of the cluster concept will the third subsection focus on the view of Porter regarding clusters. The approach of Porter has a central place within this thesis because of the fact that his view focuses on the clustering of firms in combination with the interaction of the institutional surrounding (van Hoof, 2007). The main assumption is that geographic concentration of firms is not a new process, but the observation that these clusters change character (more knowledge based and more dynamic) in relationship with each other and other economic actors is quite revolutionary with respect to former models. Porter (2002) also assumes that this process can only exist in presumably "western" and "advanced" economies. Based upon these characteristics of the Porter model in combination with its basic theoretical reasoning (this will be discussed in depth in chapter 2.3). In conclusion will the fourth subsection describe some extensions with respect to the model of Porter. In answer to several shortcomings of the model there will be an extension in order to have a framework which can be used to analyze the successfulness of Food Valley.

2.1 Clusters in general

To give an exact definition of a cluster is somewhat difficult, because in economic theories there is a broad field of research relating agglomeration economies. There are many concepts which seem to have a very similar meaning or are closely related. However in literature there is a multitude of definitions used. Atzema (2000) describes agglomerations, clusters, industrial complexes and industrial districts are widely used, but often have a overlapping meaning. So, in general there is no general approved definition of a cluster. Although this can be the case, this is not a satisfactory starting point for this research. Therefore this thesis provides a self made selection between the most important characteristics of a cluster. However in order to grasp the clusters in general it is essential to analyze certain similarities in theories.

One of the most compelling examples is the wide-spread assumption that there only is a cluster when there is a geographic area where companies are active which have a complementary core business. (Storper, 1989). Bresnahan gives the clear example of the London Financial District as a economic activity (financial sector) which is active in a relative small and easily defined area.

Secondly there needs to be an embedded economical activity in a certain territory. The definition of territory however is not fit to be used as a research starting point. Storper and Walker (1989) and Malmberg (2001) stress the importance of using the regional concept. The explanation behind this is that territory is usually linked to a sub-national scale (Malmberg, 2001), while it is from a research perspective more optimal to use a definition that covers a term relating geographic 'neutral' description. (Amin, 2000). So 'region' is a more optimal definition for this research.

The third common denominator is, that is necessary to have interaction between economical activities in a specified region. Interaction can be defined as the (in)formal contact that firms have (Gambardella, 2004) and the possibility of joining forces regarding research or marketing.

Based upon these three general similarities I will focus on two different definitions. These definitions provide a good complement regarding the three different scientific points of view that are chosen in this thesis as a starting point regarding clusters.

First the concept of the industrial district (Marshall 1920), which will be discussed in detail the second subsection.

"The industrial district is a socio-territorial entity which is characterized by the active presence of a close cooperating population of firms in a naturally and historically bounded area." (Becattini, 2000)

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Becattini (2000) stresses that not only the geographical concentration of firms is important, there is also a focus on the community of firms and their linkage (cultural and historical) to a certain region. This community and the ability to maximize its potential is an important factor in the formation of a cluster and is a key factor in the successfulness of a cluster

The second definition used is specified to clusters. Porter (2002) defines a cluster as following:

"A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities."

It is important to realize that this definition of Porter does stress the importance of the fact that companies should be linked to one another or with supporting institutions and should have complementary activities or activities that have common ground (Markusen, 1996).

Porter (2000) also describes that the grouping of firms with the same activity in a specific region is not something new to history. Take as example the textile sector in the area of Enschede, however the concept of a cluster is a more recent development. The reason why, is because of changes of the economy. Porter argues that a cluster mainly can develop in western and/or advanced economies; this is because economies have to be complex, knowledge based and dynamic to fit into the principles of cluster formation. This definition of a cluster contains also multiple geographical scales. According to Porter it is possible to analyze clusters at a(n) local, regional, national or international scale. The main focus will be on a regional scale, this implies that ideas regarding the geographical scale of clusters will not be viewed on an international scale or on certain ranges. Demarcations made by May (et al., 2001) that restricts the cluster area to fifty miles are quite arbitrary and will not be viewed as a starting point. It is not possible to exactly define 'regional' so the analyses regarding the scale will not have an arbitrary proximity. In chapter 3 there will be a more extensive explanation of the area of research regarding the geographical scale.

In order to give a better insight in the concept and so ultimately construct an workable framework of a cluster will the second subsection focus on the historical development of the theory behind industrial districts and clusters. The third subsection will give a closer elaboration of Porter and his thoughts and theories regarding the cluster concept.

2.2 History of the cluster concept

2.2.1. Since the dawn of time

Throughout history there have been tendencies for entrepreneurs to join their activities in a specific economical environment. Normally the availability of basic resources was sufficient cause for firms to group together. An European example is the pottery sector in Germany. The area of Meissen was in the 18th century the centre of pottery production for almost whole Europe. With respect to the development of the prime example: Silicon Valley it is easy to observe that there are more input factors are important than just basic resources.

Until the 19th century the general point of view was that the clustering effect was for a limited time. A hypothetical case to describe this development was very famous in that time (Bresnahan and Gambardella, 2001). As a starting point there should be a large group of firms in the same sector or with the same production characteristics that are grouped together in a certain area. The consequence of this is that there will be a high level of investments in that specific area, because of the firm expansion. The firms that require space for their activities will claim land, which will lead to a sharp increase in the price of land. Assuming constant returns to scale the increase in land prices will lead to declining margins of profit, *ceterus paribus* (Von Thünen, 1826) Besides, the living costs of employees also increase because of the more expansive land. Firms would like to maintain the –high quality- workforce and to do so they need to increase wages. Which also lead to a diminishing profit, firms observe their relative low competitive ability due to the low(er) profits and move away to other locations or end with their production activities. Eventually this leads to the disappearance of the cluster. In theory this sounds like a valid economical process, however the general observation contradicted this hypothetical case.

2.2.2. The Marshallian Insight

Finally in the early '20's of the previous century the famous economic scholar, Alfred Marshall, tried to explain the phenomenon of industrial clustering and the sustainability of these areas. (Wallsten 2001).

Marshall (1920) observed that firms continue to cluster successfully in the same locations (McCann, 2001). This should imply that in contradiction to the hypothetical case the companies are able to achieve increasing return to scale. Marshall argues that this is because of three different "sources". A local skilled labor pool, the existence of information spillovers and so called local non-traded inputs

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1. A local skilled labor pool

The existence of a high-skilled labor pool is a clear asset for a region, because firms are able to reduce labor costs per unit. High skilled personnel are able to produce the same amount of output in less time than the 'average' worker; however this is usually the result of intensive investment in training and instruction for the employees. A firm is bound to invest in its workforce to assure that employees carry their tasks out correctly, especially in knowledge intensive firms these costs relating training are high because of the opportunity costs and invested time of this labor related investment. If a firm has the advantage to be located in an area with a large pool of highly skilled workers (for a specific industry) then the costs of training will be relative low what is clear advantage over other firms that are not established in the region.

Besides, this source of increasing returns to scale suggests that firms require certain quantities of labor supply in order to react to changing levels of desired output. Assuming a growing firm has a demand for new personnel, the firm needs to invest in recruitment of personnel. When an area has a relative high count of qualified people than the search-costs, defined as effort and monetary costs, incurred are also relative low.

2. The existence of knowledge spillovers

When a large group of firms of the same industry are closely together then there is a significant change of the share of tacit knowledge. Tacit knowledge can be defined as the knowledge that isn't easily transferable and which is shared on a non-marked basis. (McCann, 2001)

The possibility of sharing knowledge with each other offers chances for transmission of highly specified knowledge (Lundvall 2002; Saxenian 1994). This specified knowledge is often embedded in routines, peoples and in machines and is therefore geographically bounded (Jaffe & Trajtenberg 1993). This implies that knowledge within a geographical proximity can result in a non-excludable public good (Phlippen & van der Knaap, 2007). This explains the geographical clustering because of the reduction in transaction costs.

A good example of knowledge spillovers can be found in London City. There is a wide-band fibre-optic cable system which is intensively used by financial firms to exchange data and information at high speed. For a small number of firms the investment of such specialist infrastructure would not be feasible, however when the critical mass of firms is larger it is possible. Besides, the cost per firm is lower when there are more beneficiaries.

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3. Local non-traded inputs

The third element within the framework of Marshall is the non-traded inputs at a local scale. In general this is a consequence of the fact that companies of the same sector are grouped together, because of this specialist inputs are more easily provided for the group of firms. This is done at a more efficient manner than would be the case if the firms were more dispersed (McCann, 2000). A good example is the numerous law firms that give specialist support for the financial centre in London (Hall, 1994). The usual costs of hiring such services are high, but due to the many firms that are located in the same place the average cost of this service will be relative low for each market participant. Another example is specific specialist local infrastructure. For certain industries the use of specific infrastructure can be an advantage. A good example is the availability of deep water and sufficient port infrastructure for the Rotterdam petrochemical industry, without these conditions companies as Shell would not be able to produce so effectively as they do now in the Rotterdam area.

Based upon this three explanations the general Marshall theorem gives an explanation why firms of the same industry cluster together in space. The explanations can be categorized as external localized economies of scale. (Henderson, 2003)

2.2.3. The Neoclassic point of view

As a reaction on the general Marshall theorem, which gave room for concepts which were not always completely scientific verifiable (for example the existence of tacit knowledge), the Neoclassic point of view developed. Although Marshall is seen by many researchers as a Neoclassic economist, his models regarding agglomeration economics and clustering is not congruent with the neoclassic point of view (Grant and Brue, 2007) In the early 20th century there was a renaissance of 'pure' economic modeling. Rational models were the only way to explain economic phenomena according to Neoclassic economist, there was no room for social factors (van Hoof, 2007). The main reason was that in the beginning of the 20th century the first large international operating firms started to appear. Companies as Ford, Coca Cola and several large oil companies appeared on the international economic arena. The independence with regard to the location site lead to the idea that there was no need for companies to work together on a regional scale and grouping together was even more of a disadvantage, with regard to competition, than an advantage (Poire, 1984). The approach that companies and people were only deciding on deterministic and simple assumptions lead to the idea that social, political and cultural processes were not relevant for location choices (Johnston, 2003). The economy was a phenomena

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which was only marginally influenced by these processes, but was independent from all other 'variables' (Martin, 2000). This seems to be no support for the cluster concept in general, however the contribution of the Neoclassic school was not regarding its view, but with respect to its research methods. The rise of rational economics implicitly meant that mathematics and statistics became more important for economists. The result was that quantitative research became more important than qualitative research (Gregory, 1983). A good example can be found in the Weber-Moses location Model (McCann, 2001). So the attention for quantitative is still the large contribution of the Neoclassic School. However in the late 20th century there was a renaissance of the qualitative method due to the fact that institutional forces, such as the government, were seen as important influence on location choice and the geographic grouping of firms. This (re)focus on institutional forces is also called the 'institutional turn' (Martin, 2000).

2.2.4. The institutional point of view

In the early 20th century there was a development among scientists to be more skeptical regarding the existence of market equilibrium. Multiple researchers focused on the concept of institutions and their role within the economy. According to one of the most important institutional economists, Veblen, it was more important to grasp the concept of how institutions act in a region than how the mechanics of the perfect supply and demand model work (Burns 1931). The main assumption is that the key of economic development is given in the capacity of institutions to adapt to changing market conditions.

In the early 1980's there was a large economic crisis. Piore and Sabel (1984) did research from an institutional point of view and concluded that one of the major causes was that (large) firms were inclined to be vertically organized. However this setup was not compatible with the changing more service and knowledge based economy. In order to cope with fast changing market conditions there was more room for specialized firms who are able to adapt faster than their large counterparts (Saxenian, 1996). However the smallness of these firms also were a disadvantage, because the scale of production was not large enough to have significant economies of scale. It was therefore that these small specialized firms were inclined to group together in small geographic regions (Storper, 1992; Scott, 1998).

This development from a scientific point of view is called the "renaissance" of the economic geography (Martin, 2000). The main contribution was that social, political

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and cultural elements were acknowledged as important elements of economical processes and are no exogenous variables regarding the location choice of firms. The fact that economical activities were seen as activities with a social basis and are closely associated with regional development gave room for researchers to explore and to develop whole new areas of economical theory. The main reason why the institutional point of view links to clusters is the attention for several other factors, political, cultural etc., then the original location factors. The research with possibility to explain why firms grouped together in a small area could be significantly broadened, which is an important asset of the rise of the institutional view.

So based upon the development of science throughout the years there is a renaissance of scholars as Marshall (neo-classical point of view) and the institutional point of view. Due to the recession of the 1980's the general corporate view changed to a less hierarchical management style and a more business unit orientated setup (Cohen, 1998). These developments have induced the interest in economical clusters. The development and the success of Silicon Valley in the latter part of the 20th century is a clear example of the increased interest in clustering. More and more Silicon Valley is taken as an example for governments to intensify the investment in a certain area with the goal to increase innovativeness and so increase the economical power of a region (Saxenian, 1998). In order to give a thorough analysis regarding this statement and to have a framework of research with respect to the main question of this thesis it is important to have a certain starting point. The model of Porter will be addressed in section 2.3 also some other issues in addition to this model will be added.

2.3.1. The Model of Porter

There are numerous researchers that have tried to conceptualize the cluster concept, but one of the most famous of these contributors is Michael Porter (Castells, 1994). The choice for Porter for the framework of this thesis is largely because his research is based upon clear fundamentals which will be discussed more in depth, secondly these fundamentals are from a research point of view not very difficult to operationalize (Hall, 1994). According to Porter is cluster theory not only a tool for manager, but also a micro economic based approach to analyze economic development (Porter 1998, Martin and Sunly, 2003). To do so it is important to compare and analyze specific –clustered- regional activities.

As said, the contribution of Porter to the concept of the clustering of firms is extensive. In *'The Competitive Advantage of Nations'* (1990) he gives a theoretical and empirical

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overview regarding the national state and the local competitive advantages with respect to the global economy. According to Hospers (2005) it can be derived from this book that Porter is one of the leading and authorized spokesmen of the cluster concept. The essential contribution of *'The Competitive Advantage of Nations'* is the acknowledgment that regional economics and social development have a strong relationship with each other. According to Porter: *"viewing economic and social issues as separate agendas was not only wrong but counterproductive"* (Harvard Gazette, 2000). In the meanwhile Porter was a profound writer of numerous papers and articles regarding the cluster theorem. In the year 2002 he wrote *"Locations, clusters and company strategy"*, based upon his research he fine-tuned some of his earlier statements and it is based upon this research that the mean definition of according to Porter:

"A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities."

As described earlier there are shortcomings with respect to this definitions of Porter. That is why later on this thesis will use its own characteristics for a region to be called a cluster. However several lessons can be drawn from the definition of Porter.

2.3.2.1. Geographic proximity in general

The proximity of firms is based upon the activity of the firm in the same region, but has no absolute figure or maximum. The basic assumption is that firms are close to each other with regard to the possibility of information exchange and the possibility of close contact. Based upon the basic theory of clusters this is essential for the functioning of a cluster. When firms are close to one another the chance that they will have informal contact. This can lead to the reduction of cooperation obstacles and makes it possible to have better insight regarding market developments and situations. The fact that information about the market is more easily accessible creates a higher productivity (Porter, 2000; Saxenian, 1994). The theory of Porter adds with respect to the model of Marshall regarding transport costs that there is a significant 'time advantage' between the idea and the actual production. Because of the shortened product lifecycles this provides an advantage with respect to the global economy (Amin, 2000).

Besides the information and distance advantage there is also a better access with respect to services and high-qualified personal. As a consequence the transportation

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costs will be reduced and the market demand for specific labor skills or knowledge will increase, because of the increased demand there also will be a larger supply.

Furthermore, as mentioned in the beginning of this chapter the absolute scale is also an important aspect of the geographic proximity. In the case of this research the preferred scale is regional. This is because clustering is a regional and local process, and however international elements always play a role (Porter, 2000) will this research primarily focus on the regional scale. The national scale will only be used if it is necessary for comparing data or drawing relevant conclusion in order to provide a better analyses regarding Food Valley.

2.3.2.2. Human Capital

As can be concluded from the previous subsection; the increased demand and therefore the larger supply for high-skilled personal from clustered firms have an impact on the composition of the labor market. Although not every cluster consists of high-tech companies the human capital is an important factor of growth. The larger market pool and the number of high-skilled laborers can make the difference between the success or the failure of a cluster. The question rises why this is the case. Before this can be addressed it is essential to define "human capital". Human capital refers to the stock of competences, knowledge and personality attributes embodied in the ability to perform labor so as to produce economic value. It is the attributes gained by a worker through education and experience (Sheffrin, 2003).

In a study done by Ariav & Goodman (1994) it has been proven that in the case of development of the Israel's Silicon Wadi the number of recent graduates with specific skills in the region were undoubtedly an important contributor to the development of the region (de Fontenay & Carmel 1997). That this isn't a stand-alone case is proven by a study of Arora, Gambardella & Torrisi (2001). With respect to the development and growth of the Irish Software Cluster it is essential to take the large pool of IT-skilled people into account.

If there is a low demand and an abundance of supply it is no sinecure that it is possible to attract higher skilled personal without problems. This induces the development of these specific clusters. A clear example of this can be found on a small scale in Sicily (Betts, 2000). The Etna Valley Cluster consists of 200 small and medium sized companies which are concentrated close to large firms as Nokia, Alcatel and Canon. The fact that this region was underdeveloped for many years, did have the

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consequence that there was an abundance of skilled workers due to the fact that the unemployment was high (around the 26%).

Even the prime example of a cluster: Silicon Valley shows this characteristic. Silicon Valley was, before it became the world-renowned cluster, a rural area where the agricultural sector was important for the local economy (Bresnahan & Gambardella 2004). Furthermore it was located in a country which was abundant of fairly high-educated people, while the unemployment level was significantly higher than in other parts of the USA.

2.3.3. Interconnected companies

When companies are vertically integrated there are benefits regarding economies of scale, stability and the protection of firm specific knowledge. The downside however is that the response with respect to moving market circumstances is lower when compared with clustered firms. A cluster is generally characterized as an open structure, as said the fact that there are many informal contacts means that communication between actors is relatively easy, so that knowledge easily can be shared between each other. At first though this could be a negative characteristic of a cluster, however Porter sees this as an advantage. Companies within a cluster are usually complements and therefore they do not compete as heavily as estimated. Usually there is a relationship which leads to mutual dependence. An example can be a firm that produces high quality furniture for the high-end market, while his 'neighbor' produces furniture for average middle class families. The focus of these firms are on other segments, but they work in each other's vicinity and they can profit from combined inventory purchase or the use of each other's expertise relating to the treatment of material. The fact that they become more and more interdependent will have the consequence that the demand for specific infrastructural works will increase. The region needs to be accessible and have good communication possibilities. Here it is possible to see a comparison between Marshall and Porter. In the example of the internet connections in London City there was a description of the knowledge spillover that could be achieved due to this infrastructural asset. It is no surprise that the better accessibility on the internet in London creates a more effective connection between firms. The result is also the transfer of knowledge (Lundvall, 2002; Saxenian, 1994). This can be explicit or tacit, which is also an element of the Marshallian insight. So the connection between firms plays a major role in the cluster concept. The reciprocal relationships combined with the mutual dependency have as a common ground that it is essential for companies to have faith in each other. The trust issue is therefore important for firms that are located within a cluster, however it is very difficult to give

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a scientific value regarding trust, so within this thesis there will be not extension of this issue. It can be of valuable interest for further research.

2.3.4. Institutional forces

Institutional forces is a broad concept, so it has to be defined before further analysis is possible. Martin (2000) defines it as a the complement of markets, companies, unions, governments and semi-governmental bodies. In order to have a workable definition the main focus will be the institutions of the definition of Martin. So semi-governmental bodies, the government and supporting companies will be addressed.

2.3.4.1. Knowledge and education

It is of no surprise that, following the analyses that a cluster needs a large high-skilled labor group, the role of a university and higher education in general is essential for the formation of a cluster.

In the beginning of Silicon Valley there was a focus from Stanford University on courses that should incline students to begin their own business in order to create their own employment. This was also supported by the possibility for start-ups to rent suitable room at the terrain of the university. Numerous large firms started that way, Hewlett Packard and Cisco are good examples.

The university trains in the first place qualified personnel for the firms and the research done by the university or the other source of higher education can lead to innovation regarding products and processes. Usually there are research based connections between firms and universities in order to create a beneficial outcome for all parties. There is evidence found by Jaffe (1989) that the spillover between the knowledge available at universities and nearby firms. In the same research it is proven that university research positively impact patenting by firms. The fact that there is a significant spillover between knowledge at a university and the firms in a cluster suggest that universities are components of the virtual (positive) circle of cluster formation. The lack of higher education in the vicinity does not rule out the possibility for the formation of a successful cluster, but it will seriously decrease the chance for success.

2.3.4.2. Governmental influence

As a consequence governmental policy measures are inclined to stimulate this (possible) spillover. In the USA and in most European countries this is done by creating so called 'science parks'. The creations of these parks are often subsidized by

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public subsidy (Wallsten 2001). Goldstein & Luger (1991) state that many parks are public corporations or subsidiaries of public universities. Vis à vis public stimulation is important in this matter and varies between subsidies, provided services, increased public transport accessibility or tax reductions. The International Association of Science Parks keeps tracks of the number of parks and the relative success of them. In 2009 there are 372 different parks spread in 72 countries. In a research done by Felsenstein (1994) it is made clear that there are two different primary objectives established with the creation of these science parks. First there is the so called 'incubator role', which implies that these parks play a nurturing role in the development and the processes around innovation and firm startups. The second objective is the 'catalyst function'. For the regional development it can be very useful to have a growth sector in the near area. This can induce a spiral of other related economic activities (Luger 1990).

The second element regarding the governmental role is the possibility to influence legislation and the underlying policy of regional development. The government can use all sorts of policy instruments to influence the success or the failure of a developing area. When the government is supportive with regard to ease legislation and to give tax benefits or other stimulus in order to give a developing cluster an encouragement this will increase the possibility of success with a large amount (Cohen 1998).

The three main elements of Porters theorem are clear from a research point of view, however in order to extend his model some additional factors are important to discuss.

2.4. The shortcomings of Porters definition

The model of Porter plays an important role in the theory relating clusters, however there are some elements and characteristics that are not treated by Porter. In order to give a thorough basis for closer analysis of the agro cluster near Wageningen it is essential to name and to describe some important extensions to the Porter model. That is why it is very important to realize that the concept of Porter is highly generic and is regarding most definitions –deliberately- vague (Martin, 2001). According to Perry (1999) this, the definitional incompleteness, is the charm and the most important reason for the success of the cluster concept. Economists are able to construct their own vision with respect to a widely accepted economic phenomenon. In extension to the Model of Porter this leads to the first element 'linkage':

2.4.1. Linkage

It may seem a surprise that the emigration of high-skilled labor can be an explanation of the development of a region. The fact that high-potentials are leaving a region to be active in another region and/or country seems to be more destructive than beneficial.

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In general this is the case, however at a regional level there can be benefits that can make the difference between the success and the failure of a cluster.

An example of India gives insight in this. In the late 1980's India had an excess supply of highly educated (mainly IT skilled) people (Ramarao, 1998). In some western countries like the United States there was a demand for skilled IT educated laborers. Obviously following one of the most logical economical theories the excess demand induced some of the skilled laborers active in an excess supply market to emigrate.

These expatriates provided valuable business links with foreign markets and led to different managerial and technical innovations in their country of birth (Arora, Gamberdella & Torrasi, 2001). Arora (2000) concluded from some field interviews done in the US that some companies outsourced some activities because of the local knowledge of some of their Indian employees. Moreover the impact of returning emigrants is also one which should not be underestimated. The available knowledge with respect to advanced business environments induced specific cluster formation in the emigration country.

2.4.2 Social networks

In response to the shortcoming of clear definitions in the Porter model; McCann and Gordon (2000) distinguished three different typologies of cluster models. First there is the so called 'pure agglomeration economies' model, which is derived from the theory of Marshall and emphasizes on external economies of concentrated firms (Bellflame, 2000). Secondly there is the industrial complexes model; which implies the geographic clustering of firms due to the goal of reducing transportation costs. Thirdly the so called social network model, which means that the success of the cluster can be explained by the strong inter personal relation between firms. Trust and institutionalized practises have a central place in this model. According to McCann and Gordon (2000) it is essential to define with an analytical research which of these types of models is dominant with respect to a particular cluster. In order to be able to compare the performance of a cluster and to draw general conclusions from that a main characteristics has to be chosen. In the case of Food Valley the main type is the "social network" model, that is because of the central regional and even national place the university of Wageningen has. This will lead probably to an abundance of (institutionalized) contacts between firms. Gordon (2000) stresses the importance that it necessary to search for the 'best fit', it is almost not possible to find exact copies of cluster areas and that is why it is important to think in concepts.

2.5 Creating a workable framework

As said there is a multitude of theories and concept with respect to clustering. However in order to get an answer on the main question of this thesis; can Food Valley be seen as a proper cluster it is essential to create a framework. This framework should describe criteria which can be used to see whether or not Food Valley is a proper cluster. Based upon the main theories discussed in this chapter; Marshall, the neoclassical view, the institution view and most important the view of Porter (including some additions) there are several criteria that should be met in order to create an answer on the central question of this thesis. I will discuss the most important issues and after that there will be given a short summary in the form of a cluster 'checklist'.

Based upon Marshall (1890) it is also important to realize that firms that are established in a certain area need to be active in a comparable economic activity, or be supporting or providing services for the core cluster companies in order to be part of the economic agglomeration. The regional element of this concept is also the cause of the spillovers. Spillovers can be defined as the learning processes which are created as a consequence of interaction between firms or via labor market mobility. However, according to Vincente and Suire (2007) it can also develop without any form of direct contact but because of mutual observation. Firms need to be closely located to each other to benefit from this. This geographical component is therefore a very important element in the cluster concept.

Another important element derived from the perspective of Michael Porter is the role of linkage between firms. The linkage is the cooperation between (specialized) firms who work together or have a close related business network. Again the driving factor is the close vicinity of each other, because otherwise the transaction and transport costs would be too influential. Although it seems that due to globalization this element does not play an important role, this would go by the so called 'distance of trust'. According to Van Hoof (2007) trust is essential for cluster formation; mutual trust exists more quickly if business partners often meet face-to-face or are in close contact with each other (Weterings, 2007). However also the non-local linkages can play an important role, as we have seen in the Indian example (part 2.4.1.) there can be a linkage with other areas that can be beneficial for an area. The criteria are largely based on the availability of modern communication and other forms of infrastructure.

According to Markusen (1996) another lesson that can be drawn from Marshall and Porter is that especially the working force is committed to the area and a disproportional share of (high-educated) workers is active with designing or

2. Theoretical background

innovational purposes. This is in accordance with the first important element of Marshall; the existence of a high-skilled labor pool. The consequence of this observation is that there should be a relative high inflow of labor in-migration and a relative low outflow of labor out-migration for higher educated people. This is also meant by Porter with human capital, which can be defined as the number of highly skilled workers (education or experience) that can be found in a specific area. It is estimated that the number of these workers are relatively higher in clusters than elsewhere.

High skilled personal usual tend to induce innovation (Koellinger, 2009) and innovation levels are essential in order to look to knowledge based clusters; where innovation is one of the drivers of firm development (McCann, 2001). This innovation can be categorized in two different groups. Product innovation and process innovation (Koellinger, 2009). If general innovation levels are high, the success rate of a cluster probably will be quite large (Saxenian, 1996).

Within the Italianate model of Markusen (1996) there is also an important role for the government that in comparison to benchmark areas is spending more time and money in order to stimulate business growth and development. This is semi-congruent with the institutional view and the model of Porter. The existence of an evident stimulating government can positively influence the formation of a cluster. Although it needs to be assessed that the role of the government is on it own not sufficient for cluster development. Saxenian (1996), Jaffe (1993), Bresnahan (1994) et al. give examples of regions where the government invested heavily on regional development, but where the cluster process failed clearly. In the Netherlands a good example is the area near Delfzijl (Tortike, 1991). The role of the government can also be extended to providing funds and possibilities for supporting institutions to establish in a certain region. In order for clusters to be more versatile it can be necessary that there is a close cooperation between private and public firms. Therefore public firms need to be localized in that specific area, which can be largely positively influenced by the government.

2. Theoretical background

As we have seen in the last subsections the cluster concept is a broad topic and it is difficult to conceptualize it due to the number of cross-used definitions and different interpretations of the same definition which lead to the following indicators which should be met if the main question of this thesis: "can Food Valley be seen as a proper cluster?" can be answered positively.

- An evident 'agglomeration' of firms and institutions with respect to a specific economic activity.
- High degree of cooperation and linkages between firms in the area
- An intensive cooperation between public and private firms.
- Relative to other regions, high levels of innovation
- The close vicinity of a relative high number of high-education institutes such as universities, research institutes and other forms of higher education
- Disproportionate (high) levels of high-educated workers in the area.
- A strong (local) government which has an important role in providing infrastructure, tax breaks and other generic business inducements in order to improve business development.

After providing a thorough analysis regarding the history of the cluster concept, the Porter theorem and the development of a framework, will this thesis continue with the methods used in order to analyze the Food Valley cluster near Wageningen.

3. Methods and research framework

After construction the theoretical framework based upon the literature study, the methods with regard to the research need to be discussed. However, first the scope of the research needs to be determined. After several important concepts are defined, this thesis will focus on the conceptualization of the elements described in part 2.6 regarding Food Valley.

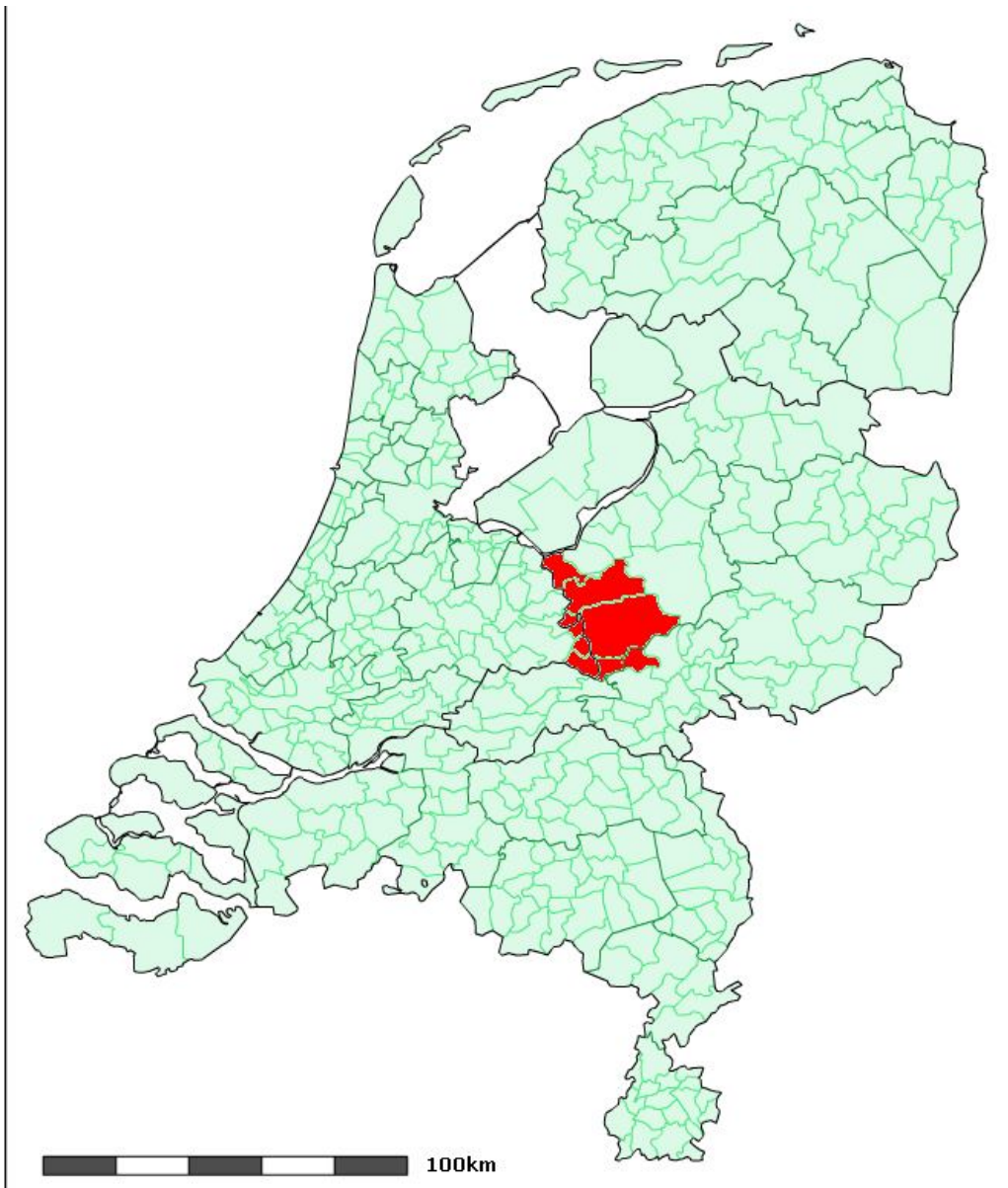
3.1.1 Regional classification

To be able to determine the regional differences and the possible deviation of data between regions in the Netherlands it is necessary to divide the area of research in several geographic parts. Based upon the data that is available thanks to the Central Bureau of Statistics it is possible to measure interregional differences in so called COROP-regions (In Dutch this stands for: *Coördinatie Regionaal Onderzoeks Programma*). The main assumption is that each region has a central core, usually a larger city, and combined with an area in the near vicinity which is largely dependent on that core for multiple purposes such as basic economical activities or commercial dependency is forming a specific COROP-region. In the Netherlands the Central Bureau of Statistics classified forty regions (Appendix A). The reason why this research chooses for the COROP-regions is that there is sufficient data available regarding these regions and their economical activities. When the scale of analyses is done on a provincial level the specific data with respect to Food Valley are measured on a (too) high geographical scale, whilst measuring on a municipality scale the data is less comparable due to for example companies that are settled in multiple municipalities. Although the COROP-regions do not have a perfect regional fit regarding Food Valley it is for this research the most optimal comparison tool. The primary region of focus will be the Veluwe, because of the fact that Wageningen and Food Valley are located in this area.

However thanks to a research done by Kraak and Oevering (2003) there is some additional data available that makes it possible to define a smaller area of research. Due to this it is possible for some research issues to keep Food Valley apart from the COROP-regions. This region near Wageningen, which is a large part of the 'Gelderse Vallei' consists of four 'central' municipalities: Wageningen, Ede, Rhenen and Veenendaal and four peripheral municipalities: Scherpenzeel, Nijkerk, Barneveld and Renswoude.

On the next page a map is shown that gives the more detailed regional division based upon the eight municipalities; these are indicated with the color red.

Figure 1:



Source: CBS, Statline

3.1.2 Sector classification

The Dutch government classifies Food Valley near Wageningen as a centre for agrifood-life sciences (Pieken in de Delta, 2004). This concept will be taken as a starting point for this thesis. According to the Dutch Ministry of Agriculture, Nature preservation & Fishery (LNV) life science related companies are specialized in utilizing knowledge regarding biological processes to develop and to improve products and processes in a wide spread of activities. It is called an “enabling technology”, which means that it supports innovation throughout a multitude of sectors. The main sectors that are of great importance are: agribusiness and life science. Further important

3. Methods and research framework

characteristics of these firms are that the focus on applying knowledge regarding the production of food and the utilization of knowledge to induce innovation in the agricultural sector. These sectors accumulated will form the framework of this thesis, other sectors are considered not to be relevant as core business for Food Valley. If the research enables it possible supporting companies such as administrators and financial firms will be treated as unique entities and not as part of the agrifood-life science sector. The Dutch Bureau of Statistic has a classification system which is used to distinguish the relevant economic activity (SBI).

Companies that are included need to be active in the agrifood/lifescience sector. There is not an exact code for this industry so several assumptions are made. In general the following businesses are included (SBI, 2008):

A01.60	–	A01.64
C10.1	–	C10.92
M72.110	–	M72.113

This is the general assumption, however it is possible that in case it is necessary that there is made a own selection because of the lack of available data.

3.2 Relative strength of an industry

In order to analyze the strength of a sector and to view how important this sector is in comparison to other regions and relative to other sectors it is possible to calculate the so called location coefficient (Atzema, 2002). As a starting point the agrifood-life science sector is taken. The regional position and the size of this industry will be compared with the size of the national agrifood-life science sector.

Furthermore this coefficient measures the proportion of firms in a sector in relationship to the number total companies in the sector in a specific country of other geographical area. The higher the coefficient is, the higher the specialization and agglomeration of that sector in that specific region. This is because the region contains more companies relating that sector than the estimated proportion of that sector. From a research point of view the Dutch economy is chosen as the total economy, due to the accessibility of data.

Mathematically this concept can be expressed as following (Kraak and Oevering, 2003).

$$Lq = (Sr / Tr) / (Sn / Tn)$$

Taking into account the different variables:

Lq: location coefficient

Sr: number of firms in a specific sector in a region

Tr: the total number of firms in a region

Sn: the total number of firms in a specific sector in the Netherlands

Tn: the total number of firms in the Netherlands.

As a starting point the location coefficient is '1', because the estimated regional proportion has the same size as the proportion of the region in the Dutch economy. A coefficient that is larger than 1 implies that the regional strength of the sector is relatively strong compared to the national economy. On the other hand if the coefficient is smaller than 1, then the sector is relatively small compared to the average .

3.3 (Inter) connection and linkage

It is no surprise that there is a difference between internal regional contacts and external non-regional contacts. Companies usually exploit their non-regional contacts for the exchange of knowledge with respect to certain specific fields of research and development (Weterings and Ponds, 2007).

Regional contacts with companies that are close located are more used for less in depth exchange of knowledge, due to the fact that companies in general fear for a loss in competitive advantage (Gertler, 2002), however the exchange of tacit knowledge (amongst employees) is according to Gertler most likely between firms that are closely located to each other. The exchange of tacit knowledge can develop as a consequence of intensive contact. It is estimated that this intensive contact is more probably to happen when people can exchange information on a regular base, due to a similarity in encountered problems or shared experiences.

With respect to this research it is necessary to define how the companies within Food Valley are connected to each other within the region, because the external contacts provide a marginal verifiable relationship with the successfulness of a cluster (Wever and al., 1991).

A major problem concerning this issue is that there are very few data available with respect to regional contacts (Ponds and Van Oort, 2006) Due to the lack of it, certain

assumptions are made which provide no perfect fit with the research. A good example is that the data regarding linkage do not regard Food Valley alone, but the whole province of Gelderland. However in order to give an insight in the development of Food Valley is my opinion that this does not harm the research, because the data that are used; are gathered by the Spatial Plan Bureau of the Netherlands (Ruimtelijk Plan Bureau) and are focussed on the life science sector in Gelderland. These data will be taken as a guideline, because a large part of the life science firms are grouped close to Wageningen (van Hoof, 2007). So there is no general conflict with the 'nature' of Food Valley and therefore the data can be partially used in this research.

3.4 Innovation: R&D output

According to Smith (2005), Lanjouw (2004) et al. it is difficult to measure innovation. This is mainly because there is no evident definition of 'innovation' and the characteristics of innovation differ from sector to sector. Authors such as Kleinknecht (2000) describe multiple disadvantages of the use of different indicators and therefore it is necessary to choose a method of analyses; although this maybe is not a perfect fit with the research. The definition of the Community Innovation Survey which is used by the Central Bureau of Statistics in the Netherlands implies that the percentage of newly developed products in the total revenue of the company. This is called innovation output. This key statistic is not used in this thesis, because of the fact that many of the relevant firms are specialised on research and therefore have no market releases of products or services. In order to cope with this disadvantage is one of the classic measurement tools relating the innovativeness of a firm the number of patent applications (Nootboom, 2000). The higher the number of applications the higher the innovation of a firm is perceived. So in general is the patent output the least bad form of measuring innovation. R&D investments could also be a possibility to measure innovation, the problem however is that data on a firm and small sectoral level are very difficult to attain. In order to have at least comparable data I have made the choice for patents.

3.5 University and higher education

Previously is the importance of the availability of highly educated personnel stressed. In literature there is often a focus on the importance of a 'key force' within a cluster. Usually this is an university or another institutional (governmental) entity (Anselin, 2000 et al.). Therefore the existence and, if applicable, the number of these institutions needs to be addressed. The higher the number of possibilities for people to educate themselves the more likely it is that a region is able to attract high skilled people in the future. Furthermore is the quality relevant with respect to the institutions. The higher the quality is perceived the more likely it is that high potentials

will establish in the near vicinity of that institution. This can be measured by the citation index.

3.6 Human capital

In general it is estimated that companies with a relative high amount of higher educated people are more successful in acquiring knowledge and applying this in the benefit for the company (Weterings and Ponds, 2007). Furthermore within the framework of Porter the existence of human capital is an important measurement of the potential success of a cluster. Human capital can be interpreted on two different scales. The first is the number of high educated people living and working in a region. The concept of 'high educated' in the Netherlands is covered by people who have attended (and completed) higher education. Therefore a degree of an university of HBO is necessary to be taken into account for this group. The second scale is more difficult to measure and is related to the tacit knowledge people acquire during their work. This type of knowledge is difficult to describe empirically, so the best measurement is the expenditure of firms in training their personnel. It is important to assume that the companies do not have arrears regarding the quality of their personnel. To rule this out this thesis will give insight the primarily economic activities of the firms active in the target region in combination with the average height of wage in that region.

3.7 The role of the government

Porter (2000), Wade et al. (2004) stress the importance of a positive and inducing role of governments in cluster formation and development. Although luck sometimes plays an important role in the cluster process (Arthur, 2002) it is necessary to research the role the government plays. However an empirical analysis with respect to the policy of a government is somewhat difficult. So the main focus will be on the several plans and policy measures the Dutch and the provincial government made in pursuit of making Food Valley to a success. As an indicator the regional spending of the government can be of support. In order to get a comparable result, a benchmark will be created in order to get comparable outcomes.

4. Results

In order to test whether Food Valley can be regarded as a proper cluster, we use data obtained from Statistics Netherlands (CBS) and other studies on agrifood-life science clusters.

This chapter will contain multiple subsections that individually describe a factor of a “proper cluster” as defined in chapter 2.6.

4.1 Agglomeration and relative strength of the sector

As mentioned earlier is a good way to address the relative strength of a sector the location coefficient method. In this research there is a focus on the agricultural and life science sector; Food Valley. A research done by Kraak and Oevering (2003) which tried to find out what the relative strength of the area near Wageningen was shows the result that can be found in figure 2. The total number of firms is the sum of all the companies that are occupied in the agricultural sector, the food industry and the knowledge intensive agri/lifescience sector. Basically the last column is relevant with regard to the research of this thesis. However to provide a broad insight in the relative position of these knowledge based firms it is needed to describe the other variables.

Regions with agglomerations in the agrifood-life science sector (figure 2)

Region	Total number of firms	Location coefficient		
		Agriculture	Food industry	Knowledge based firms
Food Valley	3549	1.53	1.61	3.99
Noord Oost Polder	1697	4.35	5.52	3.48
Noord Limburg	3553	2.23	1.21	1.31
Zeeland	3371	1.96	1.13	1.98
Zuid Oost Friesland	2807	2.55	1.77	2.12
Northern Noord-Holland	4365	1.79	1.06	1.76

Source: Kraak and Oevering (2003)

Using data from the Dutch Chamber of Commerce and the Dutch Bureau of Statistics (CBS) we were able to construct an overview of the number of knowledge intensive firms and their relative importance for the economy. As can be derived from the data the absolute number of companies in Food Valley/Veluwe (which is defined as the COROP-region where Wageningen belongs to) shows that there are areas in the Netherlands that have a higher absolute number of firms active in the agricultural and life science sector. When the relative part of economical activity in a region is viewed than it is clear that the Food Valley area is, in comparison to other areas, dependent

4. Results

on the knowledge based firms. The location coefficient in Food Valley is 3,99 with the Noordoostpolder as second (3,48) and the other regions have a coefficient of approximately half of Food Valley. So the abundance of knowledge based companies in Food Valley is more clear when there is a specific view on the knowledge based firms. Food Valley has a low location coefficient relative to other regions with regard to agriculture and food industry. This implies that the number of knowledge based firms is high represented. The view of a more knowledge based agglomeration of firms is strengthened by the following observation:

Selection of regions with respect to the number of knowledge based institutions regarding the agrifood-life science sector (figure 3)

Region	Number of companies in the agrifood/life sciences sector (knowledge based)	Portion of the regional economy	Location coefficient
Food Valley	67	0.28	3.99
Northern Noord-Holland	33	0.12	1.76
Arnhem/Nijmegen	30	0.07	1.01
North-Easth Noord-Brabant	27	0.06	0.79
Groningen	26	0.12	1.75
Rijnmond	27	0.06	0.79
Utrecht	55	0.08	1.17

Source: Kraak and Oevering (2003)

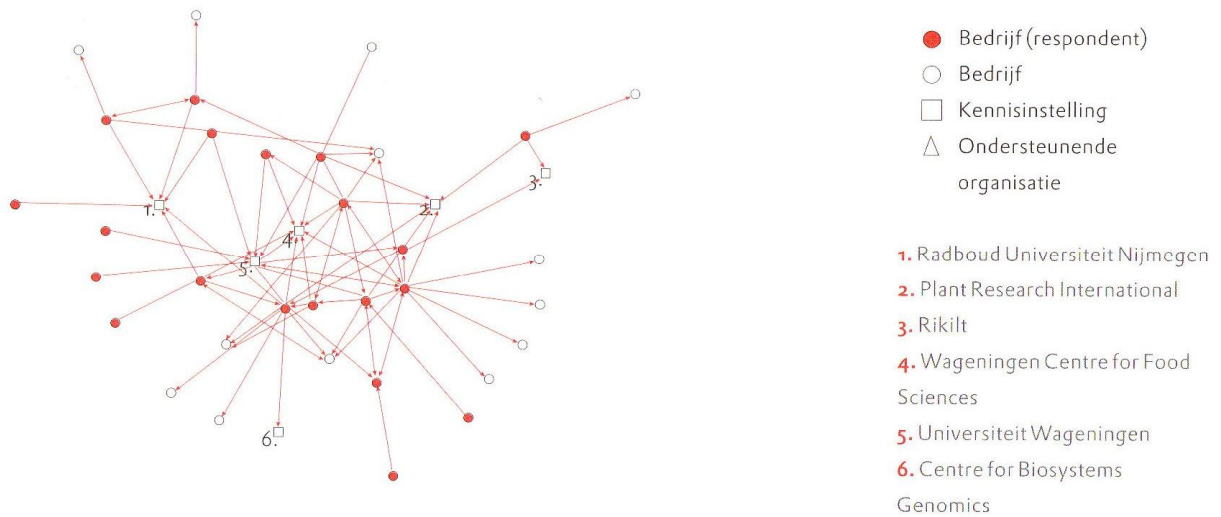
The total number of firms that is knowledge intensive is 67. Food Valley is the “market leader”, because areas such as the province of Utrecht (55 firms) and the area of Groot Rijnmond (27 firms) do not even come close to the absolute number of Food Valley. The relative share in the economy is also very high in Food Valley. Twenty-eight percent of all economic activity is cluster related (knowledge based in the agrifood life science sector), while most areas not even exceed ten percent. The location coefficient again strengthens this statement.

So the conclusion can be drawn that with regard to knowledge based life science firms Food Valley is one of the most important areas in the Netherlands and based on the data can be seen as agglomerated. However in other core businesses such as agricultural production the role of this area is only marginal. Important to address is that a cluster is not sole dependant from one type of business. Usually there are several types of economic activities that have a central place in a cluster. In order to research Food Valley it is sufficient to look for the knowledge based firms, because of the high number of university related activities (knowledge based) and the –for now- limited number of other firms.

4.2 Cooperation and linkage

As described earlier is data with respect to linkage and cooperation very difficult to obtain. There are very few accessible databases, so in order to get insight in this matter I draw on the research conducted by Weterings and Ponds (2007). They obtained data by enquiring several firms in Gelderland. The drawback of using this dataset is that the overall response rate was quite low (20 responses for the life sciences sector in the target area), the data can be biased and finally there is no second data available to check the validity of the outcome. Although there are several shortcomings with respect to this data there are however certain conclusions that can be drawn.

Figure 4: Linkage of firms



Source: Ruimtelijk Planbureau

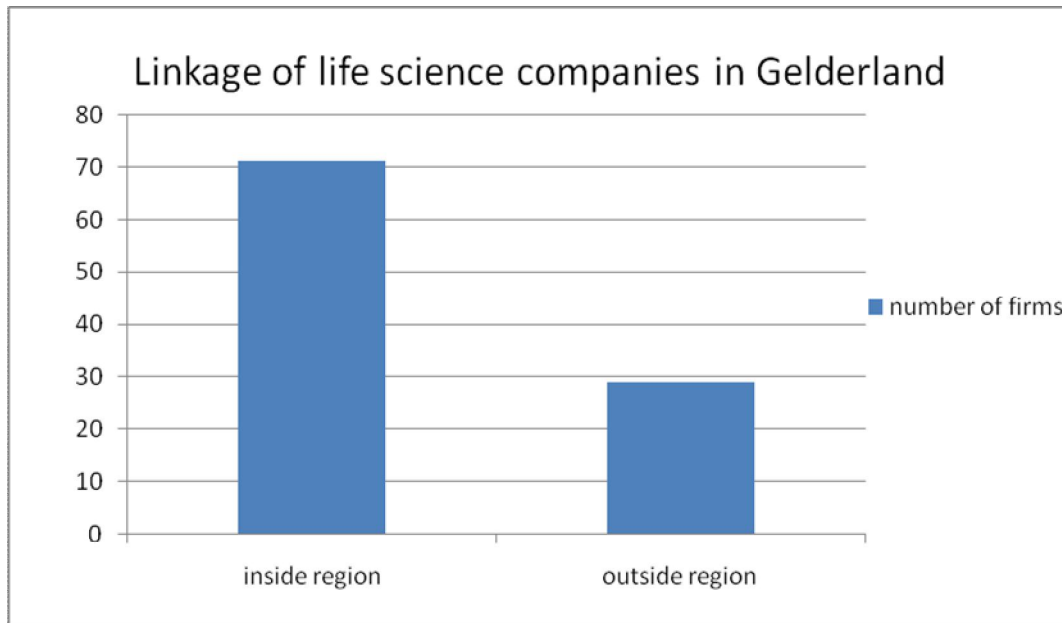
Figure 4 indicates that is made to describe the linkage between firms and between other institutions. The red dots are companies that have responded to the survey made by Weterings and Ponds (2007). A square indicates a knowledge based institution such as an university. The numbers 1 to 6 are specific institutions that have their place in the network. The figure describes that number 4 (Wageningen Centre for Food Science) and number 5 (University of Wageningen) have a central place in the regional knowledge network of Gelderland. Furthermore it is evident that the linkage and cooperation between firms is somewhat low when this is compared with several other areas in the Netherlands with cluster tendencies (such as the health cluster near Nijmegen). There is no single firm that is linked to more than four or more other companies. However most firms are more focussed on the institutions that are near to their location. In general, based on these data, can be concluded that firm linkage

4. Results

between private and public companies is more widespread than linkage between two or more private companies.

Another phenomenon that needs to be analyzed is the role of linkage outside the area. Based upon data of the Ruimtelijk Planbureau (in English: Netherlands Institute for Spatial Research) it is possible to derive the following figure

Figure 5: Linkage of life science companies in Gelderland; internal vs. external



Source: Ruimtelijk Planbureau

It is clear that there is a primary focus on the 'own' region instead of focussing on firms that are outside the region. This supports the idea that there is a dynamic exchange of business knowledge inside the target area of this research. It is important to realize that the linkage that is measured is a formal interaction. So business relationships that are acknowledged by doing business together. Informal contacts such as employees that know colleagues from other businesses and have close contact with them are not taken into account. However without a benchmark these data are quite pointless, in the research of the Ruimtelijk Planbureau there is a cross sector analyses been made. In comparison with life science companies in Zuid-Holland there is a more external focus. In Gelderland we can observe a ratio of 71% internal and 29% external, while for companies in Zuid-Holland this ratio is 62% versus 38%. The question that rises is if this are significant differences. Due to the limited number of response, combined with the marginal difference, leads to the conclusion that there is an absolute difference in internal and external focus, but this is only quite marginal.

4.3 Level of innovation

Primarily the level of innovation can be measured by the patent output in a certain region. Usually these data are very difficult to attain, because of limited regional attention for patent output. The data that are used in this thesis are a combination of data accumulated by Technololis (2005), Bobeldijk and Van Dieren (2005), het Ruimtelijk Planbureau and Centraal Bureau voor de Statistiek (CBS).

Again there is a nuance with respect tot the data. The four central municipalities of Food Valley are taken as a reference point. There is by my knowledge no data available regarding the four 'peripheral' municipalities. Besides the patents that are counted in this table are with respect to the agrifood sector (SBI 2008 codes: A01.60 – A01.64, C10.1 – C10.92) and the life science sector (not yet specified in a SBI code). The research of De Jong (2008) shows that life sciences are not yet classified in SBIcodes. Bobeldijk and Van Dieren (2005) however have done extensive research to give date with respect to the patents of life sciences. The result of this research combined with the patents of the agrifood sector give the following result.

Figure 6: Patents in the 'central area' of Food Valley

Region	Number of inhabitants	Number of patents	Number of patents per capita (* 1000)
Wageningen	34.841	12	0,3444
Ede	104.771	11	0,1050
Rhenen	17.690	1	0,0565
Veenendaal	60.953	8	0,1312
Totaal WERV	218.255	32	0,1466
Netherlands	16.193.000	1892	0,1168

Source: Bobeldijk and Van Dieren (2005), Technoplis BV, CBS

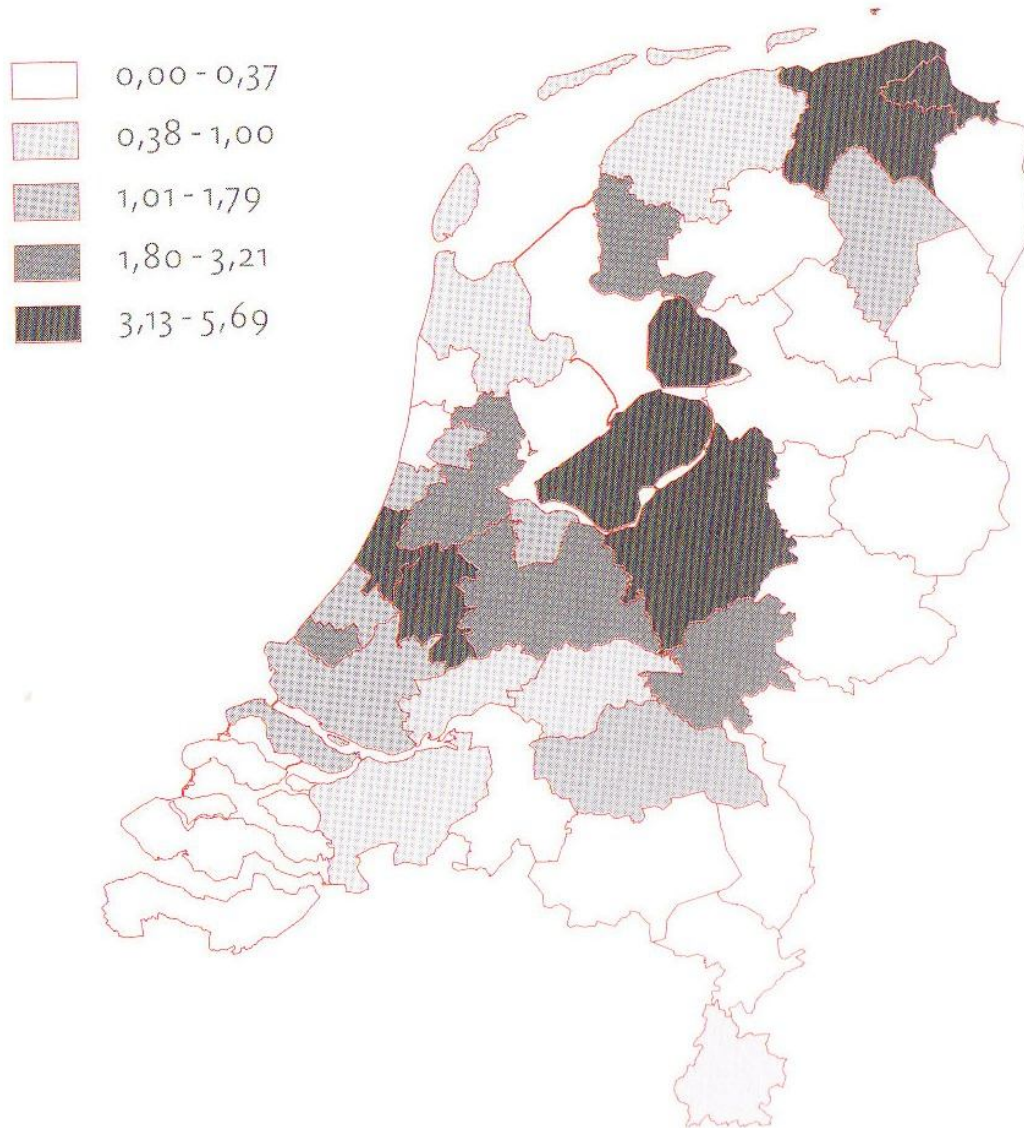
Based upon the data it seems that the central municipalities of Food Valley have an accumulated higher number of patent output per capita then in the Netherlands in general. However it is not a very large difference, but especially the municipality of Wageningen has a, relative, high number of patent applications. This data of patent output support the statement that the area near Wageningen, and therefore a part of Food Valley can be seen as a research oriented area. Which is no surprise when the location of the Wageningen University is taken into account.

The same conclusion is drawn with respect to a research done by the Ruimtelijk Planbureau. They researched the location coefficients of patents in the life science

4. Results

sector. To do so they used the EPO-data of 2005. The following result was attained (see below):

Figure 7: location coefficients of, uniquely, the life science sector



Source: Ruimtelijk Planbureau

Also these data give insight in the relative high number of patent applications in the COROP-region Veluwe; where Food Valley is located.. Along with the province of Flevoland and with several parts of Groningen and Zuid-Holland the Food Valley area has the highest location coefficient. In part 3.2 I already discussed how the principle of the location coefficient works, so how higher the number how higher, relatively, the output of patents in the life science sector.

4.4 Universities and high(er) education

Agrawal and Cockburn (2003) have done research regarding large knowledge institutes and their role for a cluster. Their vision is entitled as the anchor-tenant view. The assumption is that a large institution (e.g. a university) is the 'anchor' and that multiple small firms can benefit from it by using the local (social) networks that have been created. With respect to the situation in Food Valley it comes clear that the university of Wageningen has a major role in the development of the network. As we have seen in the figure in part 4.2 is that Wageningen University is very important for Food Valley.

To analyze the importance of the Wageningen University with respect to the agrifood and life science sector on a more (inter)national scale it is possible to measure to number of citations of researchers of this university. When an analysis is made, with respect to agri-food sciences, then Wageningen is part of the top five in the world (Boekholt, 2005). In research done by the European Committee in order to analyze the impact of universities in their importance on their main area of interest the following result was obtained:

Figure 8: Citation analysis

Name	No. of publications	No. of citations	Field norm. citation score
Nijmegen University	9648	50840	1.05
Erasmus University	8995	65171	1.32
Leiden University	12585	86682	1.25
Wageningen University	9556	40850	1.17
University of Twente	3182	10506	1.34
University of Eindhoven	3617	12156	1.40

Source: European Report on S&T indicators (2003) and European Commission DG research.

The citation score is 1,17 which implies that this university is relative successful in publishing academic valuable work. The higher the score is above the 1.0, the better the citations are rated by other institutions and colleagues. However when the general outcome of other universities are compared then the effort of Wageningen University is not that good. Problem however with these data is the lack of comparability between the main areas of research. That is why in appendix B I show the importance of the Wageningen University with regard to the agricultural and bio/life science sector. The green colours indicate that the university is relatively strong in these areas of research.

4. Results

As described earlier has the Wageningen University a central place in the Food Valley, but an university alone is not sufficient to give sufficient spinoff for companies to develop on. The educational infrastructure needs to be broader. This leads to the total number of relevant higher education institutions that are summarized in the following figure:

Figure 9: Universities and higher education in Food Valley.

Universities	Wageningen University
Higher Education	Hogeschool Larenstein
Important research institutes	Alterra
	NIZO food research
	Wageningen Centre for Food Sciences
	WOT Institute for Food Safety
	Plant research international
	Agro technology and food innovation institute

Source: Technopolis

The existence of a broad educational layer can also have a positive effect on business development. In reaction to developing business as a spinoff from the university, the WUR initiated the Wageningen Business Generator. This is an institute which combines initiatives to support young entrepreneurs and business start-ups. The main goal is to identify business initiatives that have potential for the future and supporting the initiators in setting up the business. The target group are students and the support mainly focuses on assisting with making business plans and patenting ideas or products. There is even a small amount of capital available for a select number of entrepreneurs so that the university can participate in the business setup. When the Wageningen University participates financially they become shareholder and this leads to a broad network of small firms that have a close connection with the university. Until now there only a handful of businesses that have participated in this opportunity. A possible explanation of this could be that most patents and ideas relate already existing companies.

4.5 Educated workforce?

Based upon statistics that are made available by the Stichting Food Valley there are 8500 people working in knowledge based institutions that are part of Food Valley. A large part of the workforce, approximately 6700 people, is directly or indirectly linked

4. Results

to the Wageningen University. The abundant presence of public linked employees is mainly because of the Wageningen Centre for Food Sciences which is a part of Wageningen University and has many close relations with 'normal' business life. There are several businesses that thrive on a niche segment of well educated people. A good example is the existence of a bureau which is occupied with detaching employees in food related (knowledge based) activities. This bureau, DUPP, is the only one specialised in this sector in the Netherlands and is located in the municipality of Wageningen.

However these general data provide no insight in the relative presence of educated people. In order to be able to give insight in this matter the following figure is relevant:

Figure 10:

Industrial sector	Workforce in the WERV municipalities
Agri	2512
Food	1370
Research & Development	3322
Academic education	2890
Supporting industries	731
Total	10825

Source: CBS Statline (2004), Boekholt and al (2005)

Based upon these data it is possible to calculate the location coefficient of the Food Valley related activities within the WERV municipalities. This coefficient can be calculated as following:

The total number of jobs in the Netherlands with respect to sectors as described in the figure: 318.500 divided by the total number of jobs (6.979.400) in 2004. Which is 0,0456.

When the situation in de WERV municipalities is analyzed the result is:

Total number of jobs: 103.333. So 10.825 divided by 103.333 is 0,1047.

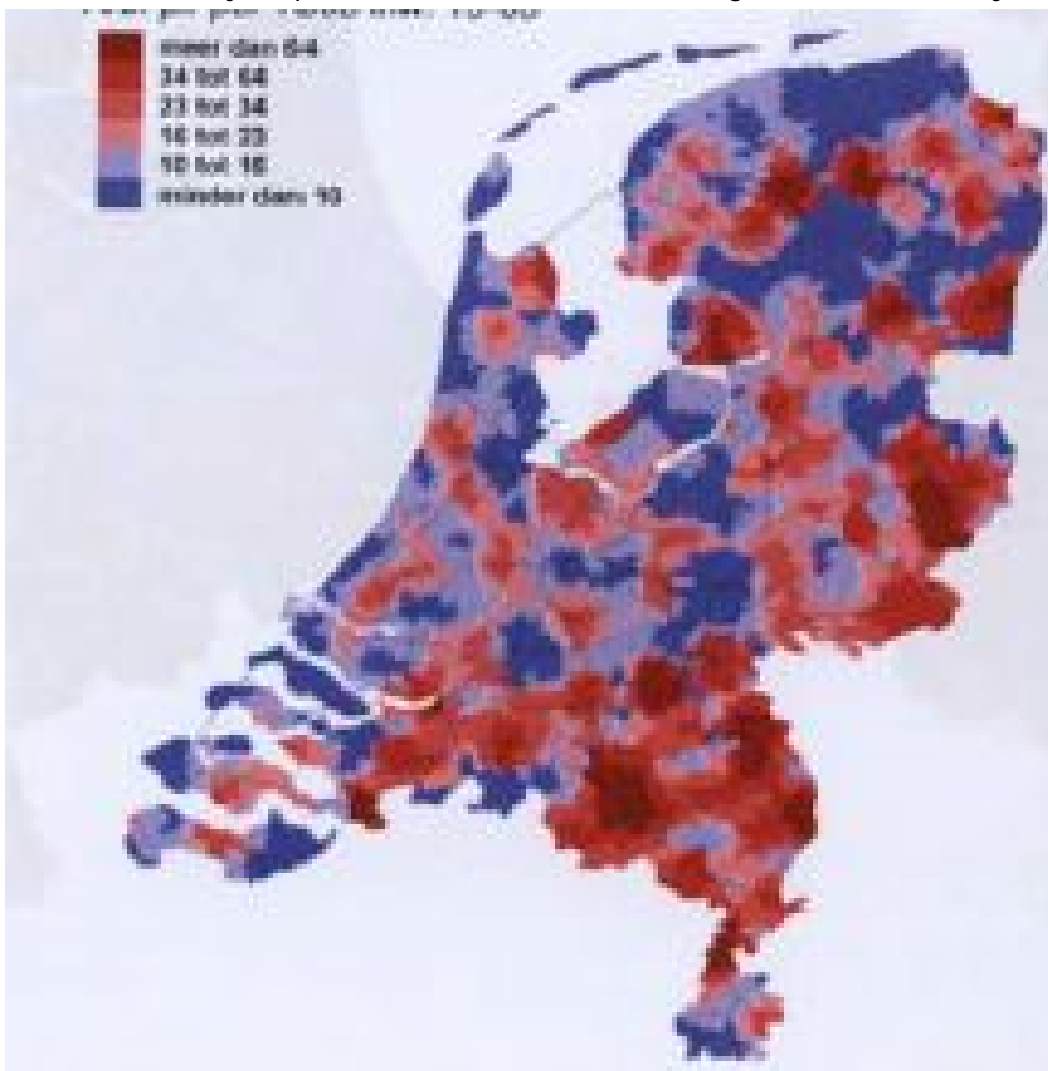
This number is 2,296 times larger then the Dutch average, based upon these data it can be concluded that the workforce which is occupied in higher educated business is relatively overrepresented.

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This can be supported with the following figure with respect to the average contribution of participation of labour in Gelderland as a percentage of the whole Dutch economy.

When these data are linked, in general, to knowledge intensive industries the following result is obtained. As can be seen, in the WERV areas the number of knowledge intensive industries is not very high. However based upon our observations the total number of these job spaces are rather low, but relatively the number of job space in the agrifood sector is quite high.

Figure 11: number of jobs per 1000 inhabitants in knowledge intensive industry



Source: Technopolis

4.6 The role of the government

Before the role of the government can be described it is essential to give a short summary of the growth path of Food Valley and the role that the government has played on the development process.

According to Crombach (2005) the official start of Food Valley was in 2004, however this creation was not from scratch. The process started around the year 1997; a small initiative called Wageningen Foundation City of Life Sciences was started. The regional development agency East Netherlands supported together with the province of Gelderland the focus of the area near Wageningen on concentrating innovative companies with regard to food and associated research companies. Their main purpose was to improve the synergy between the public and the private sector with regard to business development. The Ministry of Economic Affairs of the Netherlands subsidized the initial idea with 2,2 million euro's, besides the province of Gelderland made 1,4 million euro's available to support the development. The Wageningen University did initially not participate financially, but supported the idea in –kind. A large sum was invested in the creation of the WCFS (Wageningen Centre for Food Sciences), which is momentarily called the Top Institute Food & Nutrition. When the WCFS started it was the plan that in the first five years there should be research done for large food co operations. In order to do so there was needed 14 million euro's, which should be financed by the government and some individual firms.

In the summer of 2003, the year before the official start, of Food Valley there was made a business plan by the regional development agency East Netherlands in combination with the Wageningen University and the eight municipalities to develop and to enhance growth with regard to the agri-food sector. For the period 2004-2007 there was raised an annual budget of around the 440.000 euro's. Were 265.000 euro's (approximately 60%) are paid by the national or the regional government.

In 2003 the so called "innovation action programme" (IAP) was set up. This led to received co-funding for innovative project from the European Union. A total amount of 2 million euro's was gathered in 2003. These financial means were used to support several ideas such as the Milk Genomics project, the Milk made to measure and the Restaurant of the Future project.

Recent data, 2007, show that the Ministry of Economic Affairs has promised to subsidize 30 million euro's in order to improve several infrastructural and other innovative business models (Van Hoof, 2007).

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Another initiative of the local and the national government is founding the Food and Nutrition Delta. This is an initiative to stimulate innovate businesses. They try to achieve this goal by subsidizing rent for offices and offering a broad network of investors. Examples of firms who take advantage of this institution are IBN Food safety and Campina innovation.

The province of Gelderland, together with the municipality of Wageningen participated also in an initiative which is called FINE (Food Innovation Networks Europe). This is a project which is financed by the European Union and tries to shorten the learning process of establishing business contacts internally in the clusters and externally between concentrations of comparable business activity.

Figures with respect to expenditure of F&ND and FINE are not published, so the costs and benefits are difficult to estimate. However the existence of these initiatives can be viewed positive and have possibly, in the near future, good effects on the cluster development.

Furthermore is the WERV-initiative, which is a cooperation between the four central municipalities in Food Valley, an important platform for regional development in the future. Because of the good contact between the different municipalities in order to make Food valley to a success, it is a logic consequence that the competition for attracting businesses is of less importance. Due to the higher levels of governmental cooperation it is possible to reach a higher level of social welfare (Frank, 2006).

5. Conclusion

As stated earlier is the main question of this thesis: can the cluster near Wageningen ("Food Valley") be considered as a cluster proper? In my theoretical framework several cluster characteristics were defined. In order to draw conclusions I will discuss the different characteristics sequentially. A summary of the findings can be found in figure 12.

The first characteristic of a proper cluster is the intensity of agglomeration of firms. The location coefficient gives insight in the relative strength of a sector in comparison with other parts of country or region. When Food Valley is analyzed in relationship with comparable benchmarks then it is evident that the number of firms that are involved in the agrifood sector are high. The location coefficient is 3,99, which implies that the number of firms in this sector is larger than what is the average in the Netherlands, so the relative strength of the agglomeration is without discussion. The main concern is the small number of firms, only 67 'relevant' firms are located in the Food Valley cluster. This low number can lead to a very vulnerable evolution process of the cluster, because of the dependency on a small base of firms the effect when several parties end their business activities and move elsewhere is large.

Cooperation between firms, combined with the internal linkage, are also important characteristics of the cluster concept. Data with respect to these linkages are difficult to obtain, however based upon the collected data it is possible to state that the cooperation between firms is somewhat limited. There are no companies that have more than 4 business contacts in the cluster. So the amount of linkage formation is somewhat limited. When the internal linkage is compared with the external linkage then it is compelling to see, that the focus is mostly internal. This is mostly because of the number of externally linked companies is very limited. The ratio of internal, inside the cluster, and external, outside the cluster, contacts is 4:1. Therefore this is a large weakness for Food Valley. It is too internally focussed and to make things worse, this internal focus is limited.

The fourth characteristic is the cooperation between public and private firms. Because data on public-private partnerships is difficult to obtain, is the meaningfulness of this conclusion limited. The fact that the Wageningen University is important for this cluster, later more on this, implies that the semi-public sector is the thriving force of this cluster. A multitude of possibilities are enabled for starting entrepreneurs, such as the Wageningen Business Generator which guides start-ups and spinoffs. The public

5. Conclusion

institutions are therefore an ideal starting point for collaboration between (new) private firms and public firms. Based upon the analyses done it seems reasonable to identify this form of cooperation as quite good.

Another characteristic of a successful cluster is a relative high level of innovation. When the WERV-municipalities are analyzed more closely it is clear that the number of patents per capita (* 1000) with respect to the agrifood industry is higher than the average in the Netherlands: 0,1466 versus 0,1168. When the municipality of Wageningen is analyzed then the difference is even larger. The patent output, which is a good indicator of the innovation strength of an area, is relatively high.

With respect to the educational options and institutes it is important to realize the large impact that the Wageningen University has on the cluster. This university functions as knowledge centre and a starting point for entrepreneurs and researchers to employ their activities with regard to the agrifood and life science activities. The data of the linkage of firms in combination with the citation overview of the Wageningen University show that the main catalyst of innovation in Food Valley is this university. The role of the university is also evident in for the future success of the cluster. The fact that students are educated close to an area where they can relatively find many jobs is a major advantage in order to guaranty continuity of the cluster. Besides the important role of the university there are several research institutions that are unique for its kind in the Netherlands, the implication is that this draws specific business activity to the area. This strengthens the overall position of the cluster; however it needs to be realized that these activities only are only a small portion of overall cluster activity. In general the activities are publically research related.

Closely related to the availability of higher education is the question whether or not the workforce is relatively high educated in order to be valuable for the knowledge intensive business spectrum. Normally this is a result from simple demand and supply (*ceteris paribus*). The larger the demand for highly educated personnel is, the more companies are inclined to pay higher wages. Which attract the targeted employees. The data with respect to the number of knowledge based jobs in the area of Food Valley show that this number is relatively low. Although the knowledge based jobs with respect to the agrifood industry are more frequently available. This lead to the overall image that the availability in general is limited, but for the cluster related business activity is large. When this is combined with the near vicinity of the Wageningen University, which consist of specialist concerning relevant research areas, is the prospect of a pool of sufficient educated workers good.

5. Conclusion

The final characteristic is the role of the government. First it needs to be realized that the concept of Food Valley originally was a regional initiative to induce business development in the area near Wageningen. Due to the efforts of the local government and other institutions such as the Stichting Food Valley the cluster developed to a cluster with national appeal. This resulted in the possibility to attract several international investors and the financial support of the European Union. However when the investment ratio and the public investment in general are analyzed then the role of the government is somewhat mediocre. The reasonably low levels of governmental spending in infrastructure and other forms of subsidizing business development and start-ups influence the chance of a long-term competitive cluster.

In order to get a good overview with respect to the different characteristics that define a proper cluster is the following summarizing table essential.

Figure 12: Strengths and weaknesses of Food Valley

Subject	Analysis / score
Agglomeration	+
Cooperation and linkage internal	0
Cooperation and linkage external	--
Cooperation public and private firms	+
Level of innovation	++
Educational options and institutes	+
High-educated workforce	0
Governmental influence	0

-- = very bad, - = bad, 0 = mediocre, + good, ++ very good

The main answer on the question of the thesis is that Food Valley has several characteristics that are essential for being a proper cluster, but due to the lack of critical mass and some forms of cooperation there is not (yet) a proper cluster formed. However the process is still relatively in a starting phase, so it will be interesting to see in the future whether or not Food Valley becomes the equivalent of Silicon Valley in the Netherlands.

5. Conclusion

In order to achieve this utopia there are several recommendations that can be made. First is it essential for the government and the embedded companies to scale up. In comparison to other regions and clusters is Food Valley small on a geographic scale and also with regard to the number of involved firms. A possibility is to extend to scope of the cluster and maybe try to attract other types of business which can work as a catalyst for the already settled firms. To achieve this goal it is absolutely essential for the government to have policy aims with regard to creating possibilities instead of hampering growth due to legislation and difficult procedures.

It is also possible to give the region more identity, this can be done with the help of labelling. Labelling implies that Food Valley is presented as a brand. For example companies that produce goods try to use a uniform way of presenting themselves (using specific logos or other forms of marketing). For the area of Parma in Italy this has proven very successful, and nowadays the agrifood sector is strongly represented in this area.

The third possibility is to enlarge the chance of creating a successful cluster by making it for private owned companies easier to cooperate with the Wageningen University and other related (semi-governmental) institutions. When the difference between the public and the private sector is minimalized it is easier for companies to cooperate and finding mutual benefits which increases the overall cluster strength and competitiveness.

When some of these recommendations can be turned into reality then there is a genuine possibility for Food Valley to become a proper cluster. However the right amount of effort and luck is needed to become the Silicon Valley of "the Low Countries".

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IV Appendix A: COROP-regions in the Netherlands



Source: RIVM, 2008

V Appendix B: Citation analysis

	Nr. of publications	Nr. of citations	Field norm. citation score	Agriculture & Food Sc.	Basic Life Sc.	Biological Sc.	Biomedical Sc.	Clinical Med.	Earth & Environ. Sc.	Engineering	Chemistry	Physics & Astronomy	Mathematics & Statistics	Computer Sc.
Netherlands	P	C	I											
Acad. Center for Dentistry, Amsterdam	491	1 662	0.94											
Catholic Univ. Nijmegen	9 648	50 840	1.05											
Delft Univ. of Technology	5 876	18 603	1.24											
Eindhoven Univ. of Technology	3 617	12 156	1.40											
Erasmus Univ.	8 995	65 171	1.32											
Free Univ. Amsterdam	8 689	51 638	1.22											
Leiden Univ.	12 585	86 682	1.25											
Nat. Ins. Physic. And High Energy Physics	873	6 219	1.87											
Natl. Inst. Public Health and Env.	1 991	12 137	1.30											
Netherlands Energy Res. Foundation	486	1 321	0.97											
Netherlands Institute Sea Research	698	3 238	1.31											
Philips	1 923	9 384	1.84											
State Univ. Groningen	10 257	57 480	1.18											
Tilburg Univ.	460	704	0.81											
TNO	3 079	17 709	1.05											
Univ. Amsterdam	12 851	77 345	1.25											
Univ. Maastricht	4 494	23 599	1.10											
Univ. Twente	3 182	10 506	1.34											
Univ. Utrecht	14 942	80 846	1.11											
Wageningen Univ. Research Center	9 556	40 850	1.17											

Source: DG-Research
Data: ISI, CWTS (treatments)
Note: Period for publications and citations 1993-1999, citations excluding author self-citations. The overall relative citation impact score represents the aggregate of all broad scientific fields. On the level of broad fields, only those institutions have been taken into account which surpassed an output threshold of at least 70 publications during the period. The colouring signals the following:

- most actively publishing institution in field by country
- at least 25 % of total publication output across the 11 broad fields is within the marked field
- highest number of citations in field by country
- impact above world average (≥ 1.20)
- highest impact score in country by field, but below 1.20

Third European Report on S&T Indicators, 2003

Source: European Report on S&T indicators (2003) and European Commission DG research.