RESEARCH NOTE

AGRI-FOOD CLUSTERS: IS FRENCH POLICY IN LINE WITH REAL SPATIAL DYNAMICS?

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Abstract: *This paper attempts to ascertain to what extent the selected agricultural and agri-food cluster policies rely on a spatial dynamic involving real agricultural and agri-food activities in the relevant geographic area. An explanatory spatial data analysis (ESDA) is used to detect the spatial structure and dynamics of agri-food activities and to connect them to the cluster policies' locations. Results show that some cluster policies are not based on real agglomeration dynamics of agriculture and agri-food production. Those clusters develop specific collaboration, often strategic ones, with other cluster policies*

Keywords: COMPETITIVENESS CLUSTERS, SPATIAL DYNAMICS, AGRICULTURE, AGRI-FOOD ACTIVITIES

***JEL classification*:** R12, Q18

This work was supported by the PSDR-GO (CLAP). The views defended here are the authors' and not necessarily those of the organization mentioned.

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INTRODUCTION

The cluster concept is increasingly used to enhance the economic momentum of territories that compete with one another in a context of globalised economies. The work of Porter (1998 and 2000) has been very influential in this matter and used as a justification for cluster policies. A typical defense of cluster policies is that clusters bring economic gains and should therefore receive public support. France developed a policy based on this concept, which has become a pan-European trend following the Lisbon strategy defined in 2000 and laid out in the Europe 2020 plan, a strategy that seeks to make the European Union a competitive economy based on knowledge development. Under the strategy, governments are encouraged to increase expenditures devoted to research and development for innovation (objective of 3% of GDP). Hence, France is adopting a specific policy – based on the cluster models set out in the literature – to enhance territories' economic development through the establishment of competitiveness clusters [*pôles de compétitivité*]. In addition to that national-level effort, local authorities, which have their own economic development responsibilities, are also investing in the development of such clusters.

The French Government's competitiveness clusters policy was adopted in 2005. The first phase was the launch of a call for proposals to give the competitiveness clusters official accreditation. The 2005 selection lists 66 competitiveness clusters, which rose to 71 in 2009.

Studying the French case is interesting because there is a long tradition of strong government intervention regarding the location of economic activities especially agricultural ones and because French cluster initiatives are more or less unified across the country (Duranton et al., 2010). Until the implementation of competitiveness clusters, the French policies of spatial planning aimed to avoid spatial concentration of economic activities in a few territories and to guarantee equity between territories. Now, collaborations and spatial concentration of economic activities in dynamic territories are encouraged by the government. The aim is to achieve a certain "critical mass" in order to be internationally competitive and to build collaborative projects to enable companies to innovate and position themselves at the forefront of their sectors, in France and abroad. Equity considerations remain present since those cluster policies are well geographically distributed across the country and represent most economic sectors. Cluster policies in France have become very popular. However, neither the determinants of implemented cluster policies are clear nor the supported collaborations examined. As Duranton et al. (2010: p. 4) state "cluster policy (..) requires to pick not only the 'right' industries but also the 'right' territories. It is interesting to note that one of the fathers of Silicon Valley, Frederick Terman, who was the vice president of Stanford University, was unable to replicate this experiment in New Jersey a few years later when called upon by the Bell Laboratories (Leslie and Kargon, 1996). There exist actually very few examples of public policies that were successful in promoting clusters". In this respect, the question regarding the French competitiveness cluster policies is: is there any evidence, within the considered sector, that the selected location of the cluster was actually grouping more agglomerated activities?

To analyze how clusters are implemented in France and to see if cluster policies are concerned with the right sector and industry and implemented in the right territory we used explanatory spatial data analysis to detect the spatial structure and dynamics of agri-food activities and to connect them to the location of the competitiveness clusters.

To analyze the supported collaborations we constructed a network to show the interaction between the different cluster policies linked by common projects, and by economic partners involved in these projects (research and development (R&D) projects accredited by the Joint Ministerial Single Fund (FUI)). This network allowed us to show the growing trend of interactions and the type of collaborations and synergy between the clusters.

This paper proposes to first ascertain to what extent the clusters policies relative to the agricultural and agri-food sectors rely on a spatial dynamic involving real agricultural and agri-food activity clusters in the relevant geographic area. Secondly, the paper focuses on the nature and the type of links and collaborations between clusters.

The paper is thus organised as follows; In the first part French policies on competitiveness clusters and cluster policies literature are presented. In the second part we focus on the clusters and spatial statistics indicators used for the analysis of the agricultural and agri-food dynamics. In the third part we present results of such dynamics and link them to the implemented cluster policies. In the fourth part we look at the types of local linkages between the relative competitiveness clusters. Finally in the last part we conclude and present some discussion elements.

1. CLUSTER POLICIES: LESSONS FROM LITERATURE AND THE FRENCH CASE (THE COMPETITIVENESS CLUSTERS)

The policy that led to the implementation of competitiveness clusters was initiated following the 14 September 2004 meeting, convened by the Prime Minister, of the Interdepartmental Spatial Planning and Development Committee (CIADT).

A *"competitiveness Pole"* is defined as the combination, within a given territory, of businesses, training centers and research units:

- collaborating on an undertaking aimed at generating synergies through the execution of innovative shared projects, and

- having the necessary critical mass for international visibility.

Thus, the policy is clearly grounded in the concept of a *cluster* as defined by Porter (1998): "Clusters are geographic concentrations of interconnected companies and institutions in a particular field." Competitiveness clusters are clusters that benefit by specific actions undertaken by governments to support their development, in particular seeking to maintain employment within the country and to achieve international visibility.

The first phase of this French government policy was the launch of a call for proposals to give the competitiveness clusters official accreditation. The clusters may be defined by type as follows: "worldwide" clusters (7 projects), "potentially worldwide" clusters (11 projects, including Végépolys), and national clusters (53 projects). The objectives to be achieved and the level of funding are a function of this categorisation.

Money is being spent to support the competitiveness clusters' development. For the first phase (2005–2008), the Government had set aside an envelope of 1.5 billion euros, with as much again being allotted to competitiveness clusters in 2009–2011. That budget goes primarily to the "worldwide" (50%) and "potentially worldwide" competitiveness clusters (25%). In addition to that financial envelope, businesses that develop cooperative innovative projects with the clusters benefit from tax exemptions. Local authorities, primarily the regions and metropolitan areas, may also contribute to the financing of the competitiveness clusters within their jurisdictions.

The competitiveness clusters policy is an ambitious one as compared to its predecessor, the local productive system policy "système productif localisé" SPL started in 1998 and which was of a small scale and did not mobilize a lot of money. Competitiveness cluster calls on stakeholders to cooperate among themselves to stimulate innovation while still competing with one another in the open market; their cooperation is intended to generate added value, performance and growth.

The relationship between performance growth and agglomeration (clustering) processes has been studied extensively in recent years. Fujita and Thisse (2002) claim that "agglomeration can be thought as the territorial counterpart of economic growth". The positive link between growth and spatial agglomeration is mainly attributed to the fact that technological spillovers, being the engines of endogenous growth, are localized. Consequently, being close to innovation clusters should have positive effects on productivity and growth perspectives (Grafeneder-Weissteiner, 2010). Agglomeration and clustering of economic activities is a fundamental cause of an enhanced level of local economic performance, creating externalities that cause firms to grow faster and larger than they otherwise would do (Igliori, 2008).

It is commonly admitted that the agglomeration of economic activities increases the productivity of firms and some essays analyse the different economic mechanisms that can generate such gain. Those mechanisms imply that economic geography produced by market forces alone is not optimal, which justify à priori public intervention (Duranton et al., 2008).

Many authors have studied the logical underpinnings of the emergence and implementation of a cluster within a given territory (Duranton et al., 2010; Hamdouch, 2011…). The emergence of a cluster in a particular location can be explained by different dynamics. The first type of dynamics is rooted in the historical trajectories of the territories nurturing the specific advantages that lead to clustering phenomena (territorial path dependency). The second type of dynamics refers to historical accidents (random factors) and the third type of

dynamics is the outcome of strategic moves and purposive actions of particular actors and/or public policies (Hamdouch, 2011). Clusters, where actors and policy initiatives appear to be crucial in initiating or fostering clustering processes, are labelled "cluster policies". Competitiveness clusters (*poles*) are clearly considered as cluster policies.

According to the Duranton et al. (2010), cluster policies could emerge and help in two ways. First they increase the size of existing clusters and thus improve the performance of firms if the cluster size is suboptimally small. Second, for a given size of clusters, cluster policies could improve the workings of externalities (input market externalities, labour market externalities and technological externalities). Both mechanisms could increase productivity of firms in the cluster. Indeed, this definition supposes that initially a cluster does exist and that a spatial concentration of industries more or less developed does exist.

Some authors have looked at the types of relationships existing between firms in order to establish a clusters typology (Gordon and Mc Cann, 2000), while others have investigated the degree of proximity between them (Rallet and Torre, 2005), taking into consideration the spatial and temporal dimensions of the clustering phenomenon. The authors that looked at proximity between firms (Rallet and Torre, 2005) found that it took two main forms: geographical proximity and organised proximity. Geographical proximity means the physical distance between the players. Organised proximity means the players' ability to interact, whether in a formal relationship or otherwise.

As regards the study of organised proximity, the work of Porter (1990, 1998) and of two Italian authors (Becattini, 1992 ; Brusco, 1982), concerning industrial districts, are mobilized. These papers are concerned with the nature of the relationship between firms. Porter highlights the importance of formal and strategic contacts. He states that cooperation between firms, and hence their solidarity, emerges from the identification of common problems and objectives. The relations established as a result are strategic; they are short-term relations aimed at stimulating innovation. The Italian literature posits another type of business relationship: one that develops through informal contacts, based on mutual trust between the partners. Two basic rationales for the cluster dynamic have been proposed (Amisse and Muller, 2011). Under one rationale, short-term strategic cooperation is undertaken upon the cluster's establishment or after a crisis, following the identification of objectives and problems common to the stakeholders; this is the professional rationale. Under the so-called historical rationale, trust and informal relationships are established in the long term; these go beyond short-term cooperative behaviour and lead to the forging of lasting alliances based on common interests. Thus, these two rationales constitute a temporal approach to the clusters policy.

Other elements may explain how relationships arise in the case of organised proximity (Torre, 2006; Vicente, 1999, 2005; Bocquet and Brossard, 2008). Two such elements may be mentioned. The first is belonging: the fact that two players belong to the same organisation or network facilitates interaction and, outwardly at least, fosters communication. The second is likeness: the fact that

the members of an economic entity share the same references or knowledge system eases interaction between them.

In the current literature, however, it appears difficult to distinguish between these various patterns, as relations between firms may involve an alternation of competition and cooperation, and short-term alliances may be combined with more lasting ones.

Table 1. Rationales for collaboration between firms

	Historical	Professional	Belonging	Likeness
Organised proximity	Long term, forging of historical alliances, cooperation	Short term, Strategic	Belonging to same network	Same references or knowledge system
Geographical proximity				

In the following we exploit some empirical data and simple methods to see whether or not initial cluster does exist before political intervention and whether competitiveness clusters are based on a purely spatial agglomeration of firms or on complementarity between firms, belonging to other clusters identified at the national level. Also, the objective is to ascertain whether the geographical area of cluster policies matches the spatial dynamic of the relevant agricultural and agri-food activities, and then study the interactions between clusters through an analysis of the cluster network.

2. ANALYTICAL METHOD

2.1. Competitiveness clusters studied

The only competitiveness clusters considered in the analysis are those subject to MAAP (the French ministry of agriculture, food, fisheries, rural life and land use planning) that carry on an activity concerned with agri-food and/or agriculture and are strongly tied to the territory in which that activity is conducted. Clusters related to sea products were not included, nor were the InnoViandes and Prod'Innov clusters, inasmuch as in 2010 they lost their national "competitiveness cluster" accreditation. Finally, biotechnology, health and nutrition clusters were not looked at because they are highly R&D-oriented and less directly tied to the agricultural and agri-food sectors. The clusters studied were the following: Industrie et Agro-ressources (IAR), Nutrition Santé Longévité (NSL) and Vitagora. All clusters mentioned will however be taken into account in the last part of the study—network analysis—since all of them collaborate with the agricultural or agri-food competitiveness clusters.

According to DATAR (Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale) in charge of spatial planning and regional attractiveness), 14 clusters are subject to MAAP, of which 6 meet our criteria. Also, the following clusters are selected (Table 2).

Table 2. Competitiveness clusters studied

Name of cluster	Location of cluster headquarters	Main issues dealt with
Agrimip Innovation	Castanet Tolosan (Midi-Pyrénées)	Food supply chains
Céréales Vallée	Saint-Beauzire (Auvergne)	Cereals
Pôle Européen Innovation Fruits et Légumes	Avignon (Provence-Alpes-Côte-d'Azur)	Fruits and vegetables
Qualiméditerranée	Montpellier (Languedoc-Roussillon)	Fruits and vegetables, wine-growing, cereals and Mediterranean crops
Valorial	Rennes (Bretagne)	Foods of tomorrow, milk, meat and egg products, agri-food technologies and nutrition
Végépolys	Angers (Pays-de-la-Loire)	Varietal selection, horticulture, specialised plants, landscapes, wine-growing, market gardening

In order to bring out the interrelations of the clusters, agricultural activities and agri-food industries, the sectors directly relevant to each cluster have to be identified (Table 3).

Table 3. Agricultural and agri-food industries associated with each competitiveness cluster

	Sector	Agrimip Innovation	Céréales Vallée	PEIFL	Quali-méditerranée	Valorial	Végépolys
Agriculture (prod.)	Field crops	×	×		×		
Food Industries	Cereals/ grains						
Agriculture (prod.)	Fruit	×		×	×	×	×
Agriculture (prod.)	Market gardening/ horticulture						
Food Industries	Fruit/ vegetables						
Agriculture (prod.)	Milk	×				×	
Food Industries	Dairy products						
Agriculture (prod.)	Meat	×				×	
Food Industries	Meat Products						

The following agricultural and agri-food sectors are studied: field crops/cereals sector, fruit, vegetable and horticulture sector, livestock production/ meat and dairy industries. The data regarding all agriculture and agri-food industries taken together are also looked at.

2.2. Data used

The data on agricultural activities is taken from departmental agriculture accounts for 1990 and 2006 (production volume by sector, at the department

level)[1] (Ben Arfa et al., 2009). The data on agri-food industries (AFI) is taken from the 1996 and 2005 EAE surveys [Enquête Annuelle d'Entreprises] (number of establishments per sector, at commune level). This data was aggregated at the *zones d'emploi* (employment zone) [2] level, which was seen as the most relevant scale for the study of agri-food activities. The data on cluster policies comes essentially from DATAR (establishments of businesses belonging to the cluster, within the employment zone).

2.2.1. Data processing: mapping and statistical analysis

The first step is to analyse the competitiveness clusters' location and catchment area. For that purpose, the places where the clusters are active are mapped and their reach (number of employment zones covered by the cluster/total number of employment zones) and their concentration (concentration index) are measured.

To analyse the degree of spatial clustering of competitiveness clusters, as evidenced by the presence of clusters in the neighbourhood, a join-count autocorrelation test is used. The join-count statistic is a global autocorrelation test specifically designed to measure the spatial arrangement of spare outcome data. The statistic is derived from three primary components classically referenced as the number of BB, WW, or BW joins. A BB join represents the number of neighbouring areas where there are no competitiveness clusters, WW joins represent the number of adjacent areas where there are competitiveness clusters, and BW the number of areas where a competitiveness cluster exists but there is none in the connecting area.

The standard error of the expected number of BB, WW, or BW joins gauges where differences between the observed and expected joins are significantly different from random.

On the basis of the results (Table 4), an initial cluster typology can be established showing catchment areas. Some clusters, like Végépolys, have a low concentration and a large catchment area. Others, like Agrimip, cover fairly small areas and are quite concentrated. This information, taken from an analysis of cluster location, is related to the dynamics of agricultural and agri-food activities and to inter-cluster collaborations.

To detect the spatial structure and dynamics of agri-food activities and to connect them to the competitiveness clusters' locations, an explanatory spatial data analysis (ESDA) is used. The Moran's *I* tests for spatial autocorrelation is

[1] Volumes of production of agricultural products come from the "*département*" accounts of agriculture provided by the French ministry of agriculture, food, fisheries, rural affairs and spatial planning, which are best at the department level. This makes it difficult to disaggregate the data at the employment zone level.

[2] An employment zone is a geographical area in which most of the labour force live and work. Carried out jointly by INSEE and the statistical unit of the labour ministry, the breakdown into employment zones constitutes a division of the territory suited to local studies of employment and its attendant conditions. Source :
<http://www.insee.fr/fr/methodes/default.asp?page=definitions/zone-emploi.htm>

first calculated. The spatial weight matrix used to calculate this index is the queen first-order spatial contiguity matrix, describing the spatial contiguity of the employment zones under study.

Table 4. Geographical indicators for competitiveness clusters

	Dispersion/concentration Join-Count (Standard error WW)	Size of catchment area (in % of French territory)
Céréales Vallée	Scattered 1.2804	3.2
Agrimip Innovation	Concentrated 12.4532***	3.5
Qualiméditerranée	Slightly scattered 9.8357***	3.5
Valorial	Concentrated 15.58***	9.7
PEIFL	Concentrated 12.5952***	10.8
Végépolys	Slightly scattered 8.0976***	11.7

****, p<0.01.*

Table 5 displays Moran's *I* statistic for different food-processing industries for different sectors for the years 1996 and 2005 for the 348 French employment zones. Inference is based on the permutation approach with 9999 permutations (Anselin, 1995). It appears that all Moran's *I* statistics differ in a statistically significant way from zero, and that all agri-food sectors are positively spatially autocorrelated. This result suggests that the distribution of agri-food industries are by nature clustered over the two periods. This clustering is higher for 2005 than for 1996. The most clustered agri-food sector is cereal processing industries.

Table 5. Moran's *I* for agri-food industries, 1996 and 2005

	1996	2005
Cereals	0.3174	0.3709
Dairy_products	0.2064	0.2970
Fruits_veg	0.0855	0.2516
Meat	0.2559	0.3119
All AFI	0.1676	0.2044

GeoDa® software is used to calculate Moran's I.

Moran's *I* statistic is a global statistic and does not allow us to assess the regional structure of spatial autocorrelation. In order to gain more insight into how areas with a high or a low number of agri-food industries are located in France, then the local spatial autocorrelation using Local Indicators of Spatial Association (LISA) is analysed (Anselin, 1995). Local spatial autocorrelation statistics provide a measure, for each unit in the region, of the unit's tendency to have an attributed value that is correlated with values in nearby areas.

The high-high and low-low locations (positive local spatial autocorrelation) are typically referred to as spatial clusters, while the high-low and low-high locations (negative local spatial autocorrelation) are termed spatial outliers. While outliers are single locations by definition, this is not the case for clusters, and the cluster itself likely extends to its neighbours as well.

Using the results obtained, mapping may be done to identify the presence of local clusters or specific spatial units with a value opposite to their neighbours'.

3. ANALYSIS AND RESULTS

3.1. Analysis of spatial dynamics

On the basis of the indicators referred to above, maps are produced displaying agricultural and agro-industrial spatial dynamics. The maps of the relevant sectors for each of the clusters studied are presented (referred to in Table 3). For agricultural sectors the 1990 and 2006 maps as well as the 1996 and 2005 maps for agri-food activities (1990 and 1996 in Appendix) are showed. Thus, the activity locations for each competitiveness cluster and the spatial dynamics of sectors pertinent to these clusters' activities are presented.

Figure 1. LISA for agricultural production (2006) and agri-food industries (2005) and Agrimip cluster location

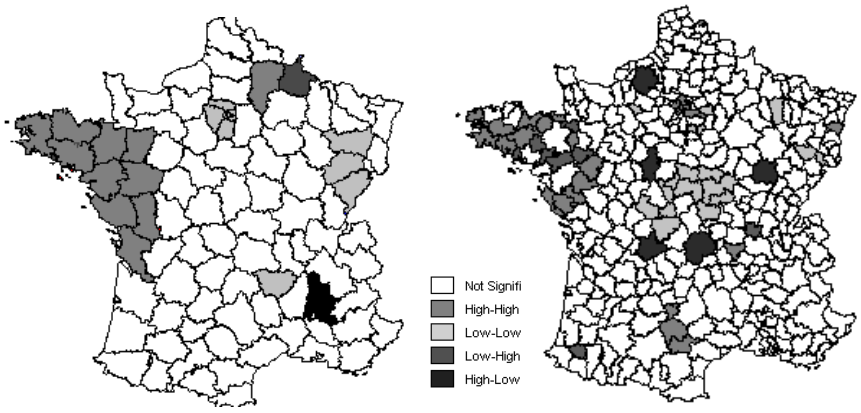


Figure 1(a): Agricultural Production in 2006

Figure 1(b): Food Industries (all sectors) in 2005

Figure 1(c): Agrimip Innovation cluster

- ***All agricultural production and agri-food industries dynamics and the Agrimip cluster***

The maps in Figures 1(a) and 1(b) show the Grand-Ouest region[3] to be the locomotive for agriculture and agri-food activities. For all agri-food industries, in 1996 (Figure A(i) in appendix) a main cluster was observed in the Grand-Ouest region and two smaller ones in Île-de-France and in the Lyon area (HH zones). In 2005 (Figure 1(b)), a main cluster is still shown in Grand-Ouest and a smaller one in Île-de-France, while a new cluster makes its appearance in Midi-Pyrénées.

Figure 2. LISA for field crops (2006) and Cereal industries (2005), and Céréales Vallée and Qualiméditerranée clusters location

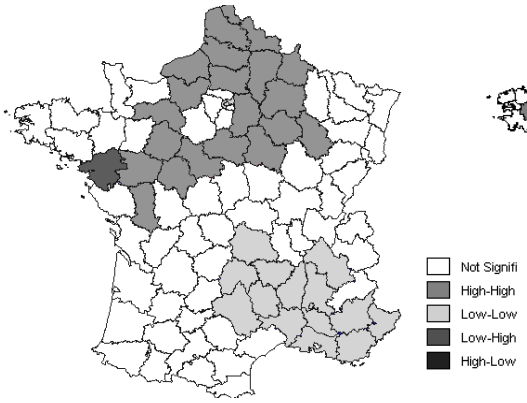


Figure 2 (a): Production of Field Crops in 2006

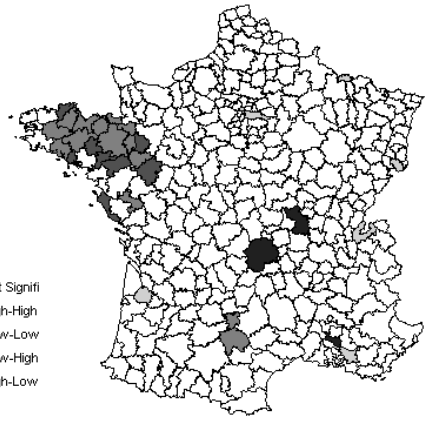


Figure 2(b): Cereal Industries in 2005

Figure 2(c) : Céréales Vallée cluster

Figure 2(d) : Qualiméditerranée cluster

[3] In our analyses we consider the Grand-Ouest as composed of Bretagne, Pays de la Loire, Normandie and Poitou-Charentes regions. Indeed, the major part of the French agricultural production is concentrated in this area.

The Agrimip Innovation cluster (Figure 1(c)) is not located in Grand-Ouest, the most dynamic region both for agriculture and for agri-food industries. It is, however, located in the southwest, in Midi-Pyrénées, where a positive industrial dynamic has recently developed.

- ***Field crops, Cereal industries' dynamics and Céréales Vallée and Qualiméditerranée clusters***

The spatial dynamic of field crops, including cereals, covers a relatively large territory. Between 1990 (Figure A(c)) and 2006 (Figure 2(a)), there was a westward shift of regions with a positive dynamic. For the industrial grains sector, one main cluster is found, in Grand-Ouest, showing little change between 1996 (Figure A(d)) and 2005 (Figure 2(b)). Animal feed industries account for the greater part of this cluster, as Grand-Ouest is an important livestock region.

The Céréales Vallée cluster's catchment area (Figure 2(c)) does not include agricultural or industrial sectors with any notable spatial dynamics. It is, however, located in an area with atypical HL behaviours (being dynamic as regards the cereals industry whereas its neighbours are not). Nor does the Qualiméditerranée cluster (Figure 2(d)) appear to inhabit an area with clustering dynamics in the cereals and field crops sector (some outliers with HL behaviours were present in 1996 but not in 2005).

- ***Fruit, vegetable and horticulture sectors' dynamics and related clusters***

The dynamics of fruit production were found to be stable between 1990 and 2006. The Bouches-du-Rhône department (southeastern France, Figure 3(a)) is the largest vegetable producer and has a highly positive dynamic. Between 1990 (Figure A(e)) and 2006 (Figure 3(c)), other departments strengthened their vegetable and horticulture position, forming a relatively dynamic cluster in western France (Brittany, Pays-de-la-Loire). The Valorial and Végépolys clusters are located there.

Figure 3. LISA for Fruit, vegetable and horticulture productions (2006), fruit/vegetable industries (2005) and concerned clusters location

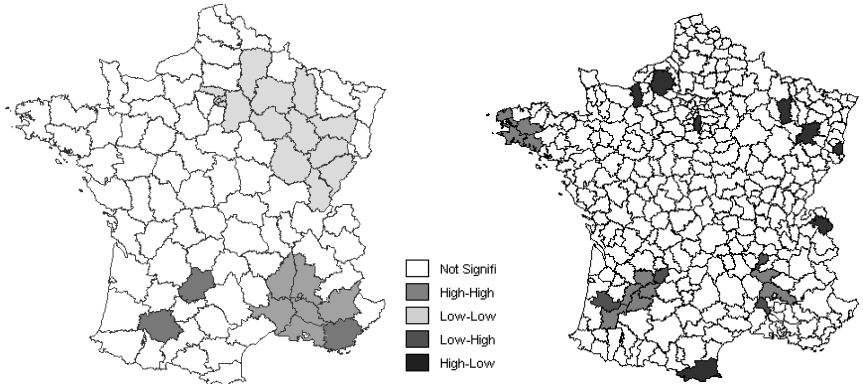


Figure 3(a): Fruit Production in 2006

Figure 3(b): Fruit/vegetable industries in 2005

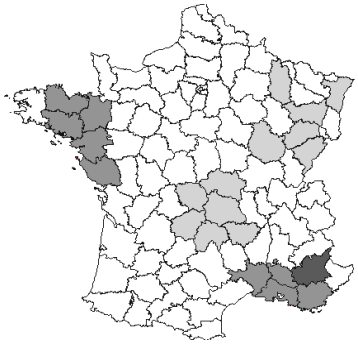


Figure 3(c): Vegetable and Horticultural Production in 2006

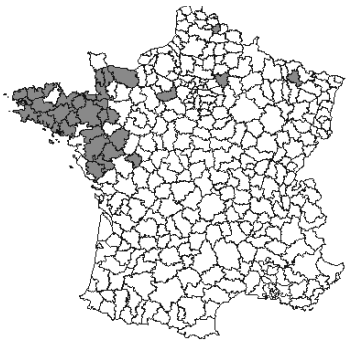


Figure 3(d): The Valorial cluster

Figure 3(e): The Végépolys cluster

Figure 3(f): Qualimediterrannée cluster

Figure 3(g) : Pôle Européen d'Innovation Fruits et Légumes

For the fruit and vegetable industry (data for the fruit sector alone is unavailable) (Figure 3(b)), the clustering zones are small. Three clusters are found in Brittany, Aquitaine and Drôme-Ardèche (South Rhône-Alpes). Those clusters have become larger between 1996 (Figure A(f)) and 2005.

Valorial (Figure 3(d)) is located in zones where fruit and vegetable industrial activities have a positive dynamic (Grand-Ouest in particular). Végépolys (Figure 3(e)) has a principal catchment area in the Grand-Ouest that is unrelated to the fruit and vegetable production cluster also found there. It also has members near the Alsace and Aquitaine industrial clusters. The presence of this cluster in the South may reflect a desire on the part of some stakeholders to ride on the coattails of the main horticultural and fruit production cluster.

Qualiméditerranée (Figure 3(f)) is preponderantly based in the South, near but not right inside the most dynamic fruit and vegetable production area. It has however a presence in Pyrénées-Orientales which appear as a new dynamic employment zone with respect to fruit and vegetable industries (it wasn't the case in 1996 (Figure A(f)).

PEIFL (Figure 3(g)) also has an important presence in the fruit and vegetable production and industrial cluster in the Southeast, and has members near or within the Aquitanian industrial cluster.

- ***Livestock production, dairy and meat industries' dynamics and Valorial cluster***

France's Grand-Ouest region has a positive dynamic for dairy production (Figure 4(a)). As regards dairy industries (Figure 4(b)), positive spatial dynamics are more scattered (Basse-Normandie, Franche-Comté, Rhône-Alpes and southern Auvergne).

Positive dynamics for meat production are mainly found in the Grand-Ouest region. That cluster expanded recently to Normandie thanks to beef production (see Figure A(g) in Appendix). Three large clusters may be identified for the meat products processing sector (Figure 4(d)): one in the Grand-Ouest, one in Midi-Pyrénées and one in Rhône-Alpes.

The Valorial cluster (Figure 4(e)) is mainly located in Grand-Ouest, at the heart of dairy production activities. As far as the dairy sector is concerned, this cluster's spatial correlation appears to be more with agricultural than industrial activities. More generally, it is located in the area where a positive dynamic exists for husbandry, both on the farm and in terms of processing industries.

An analysis of the link between cluster location and spatial dynamics indicates that some clusters rely on a strong local dynamic in agricultural and/or agri-food activities. Such is the case, for example, of the Valorial and Végépolys clusters and the "Pôle Européen d'Innovation Fruits et Légumes (PEIFL)". In other cases there is not so clear a link to local production dynamics. Examples of this would be Céréales Vallée, Agrimip Innovation and the Qualiméditérranée cluster.

After this first stage of analysis, which deals with the relationship between competitiveness clusters' emergence, their geographic extent and the spatial dynamics of the agricultural and agri-food sectors concerned, we looked at whether cooperative dynamics or other interactions beyond mere geographical proximity are operative between the clusters.

Figure 4. LISA for livestock production (2006), dairy and meat industries (2005), and Valorial cluster location

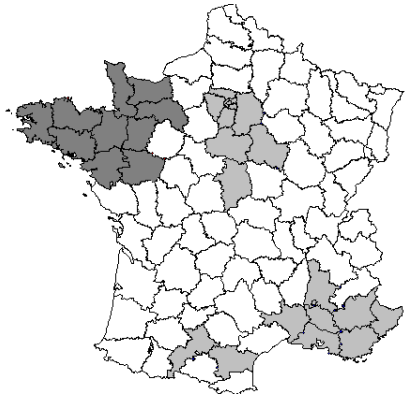


Figure 4(a): Dairy Production in 2006

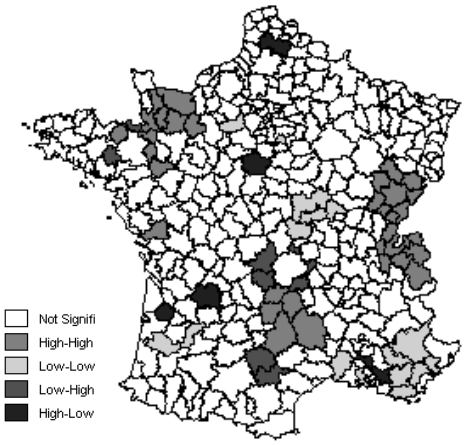


Figure 4(b): Dairy Industries in 2005

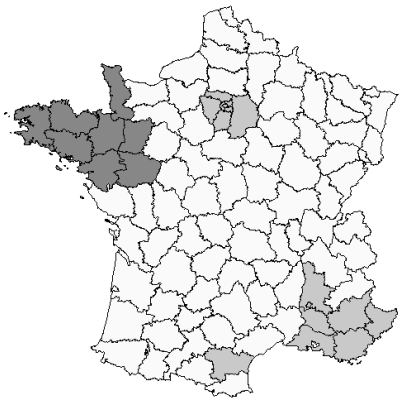


Figure 4(c): Meat Production in 2006

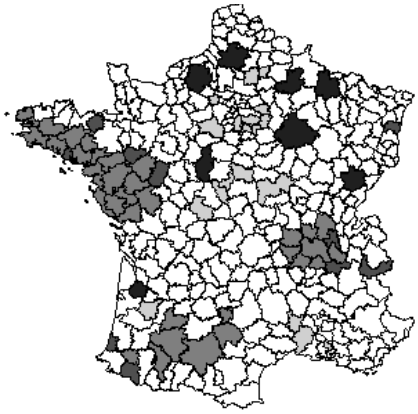


Figure 4(d): Meat Product Industries in 2005

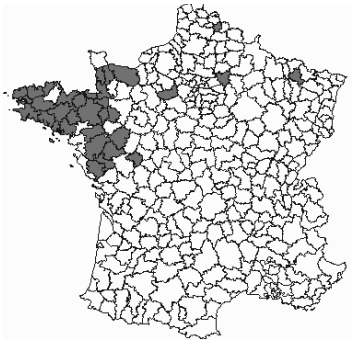


Figure 4(e): The Valorial cluster

4. NETWORK ANALYSIS OF COMPETITIVENESS CLUSTERS

Inter-cluster links – their nature, number, and density – are studied based on a network analysis. The term "network" means a set of interconnected entities that allows the circulation of tangible or intangible items between each of the entities (nodes) according to well defined rules. In our case, collaborative inter-cluster networks are considered: two clusters are linked if they both participate in a research and development (R&D) project accredited by the Joint Ministerial Single Fund (FUI) under the Government's competitiveness clusters policy (Vicente et al., 2011).

Table 6. Collaborations between cluster policies (response to the FUI call for proposals)

	Agrimip Innovation	Céréales Vallée	IAR	Innoviandes	NSL	PEIFL	ProdInnov	Qualimédi-terranée	Valorial	Végépolys	Vitagora
Number of CFPs	12	6	12	2	8	4	7	8	6	7	10
Agrimip Innovation					1S		1G	1G			
Céréales Vallée											
IAR											1S
Innoviandes								1S			
NSL	1S							1S		1S	1S
PEIFL								1G			
ProdInnov	1G										
Qualiméditerranée	1G			1S	1S	1G					2S
Valorial										1G	
Végépolys					1S				1G		
Vitagora			1S		1S			2S			
Axelera	1S										
Enfant									1G		
Fibres Grand Est	1S										
PASS			1S								
Plastipolis		1	3S								1S
Pôle européen de la céramique			1S								
Trimatec		1				1G		1G			
Xylofutur	1G										

Source: Datar, 2008.

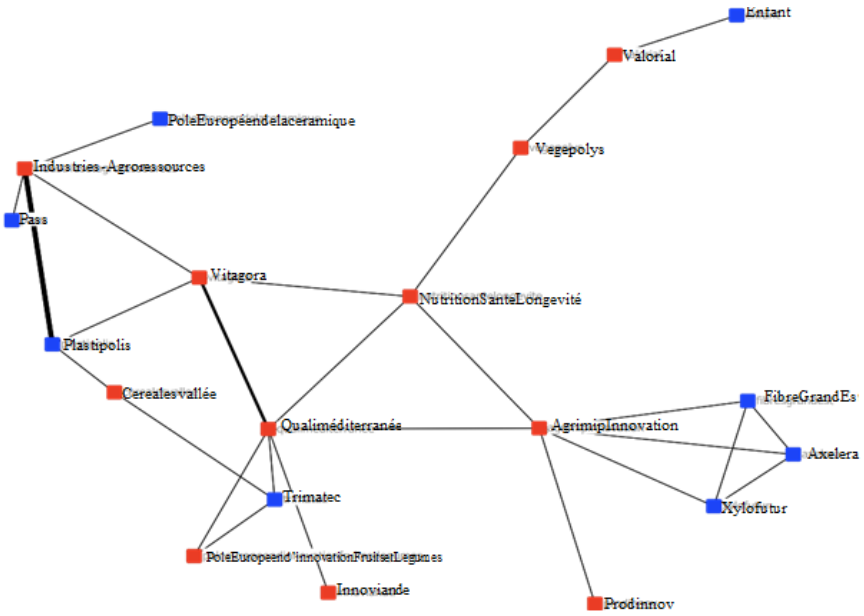
Inter-cluster linkages and their nature are analysed (geographic proximity, complementary activity); this provides indications as to the competitiveness clusters' collaboration strategies: geographic or organised proximity, belonging or likeness. It also provides guidance on the each cluster's position in the network (central position, intermediate, or end of the network).

This study is conducted using UCINET social network analysis software (Borgatti et al., 2002) and its NetDraw network visualisation plug-in. This software can perform measurements to characterise the network of studied clusters – size, number of links, network density, average distance between two nodes – and visualise the network. The results of this initial data processing step are shown in Table 6.

The first row contains the total number of CFPs (calls for proposals) bid on by each of the clusters reporting to the ministry of agriculture. The figures indicate the number of collaborations between the clusters concerned (clusters other than those related to agricultural and agri-food sectors are considered, see description in Table A.1 in Appendix). The letter S or G indicates the type of collaboration. G collaborations are more geographic in nature, as they took place between clusters physically close to one another (geographical proximity). S collaborations are more strategic, as the clusters entered into partnerships because, for example, their activities are complementary. Such collaborations may be considered as reflecting organised proximity.

Inter-cluster links relating to responses to calls for proposals are shown (Figure 5). This figure incorporates the clusters referred to in Table 6. Thicker lines mean a more intense relationship, i.e. more inter-cluster links.

Figure 5. Network visualisation of inter-cluster collaborations



Additional measures may be used to characterise the network. Network density may be calculated based on the actual number of links out of the possible number of links L, where L = N*(N-1)/2 and N is the number of network elements (N = 19 in our case). The average density is 0.17. As density can vary from 0 (no relation) to 1 (all potential links occur), this index shows that the network of relationships is sparse.

Geodesics may be used to evaluate the accessibility of network members. The shortest path connecting two nodes is called a geodesic. Ucinet® calculates an average geodesic distance of 3, a relatively high value indicating relatively difficult access within the network. This means that on the average, clusters need two intermediaries to become connected.

Specific measures are given for each cluster in the network. Degree, in Table 7, means the number of relationships each cluster is part of. Of all clusters, Qualiméditerranée, Agrimip and Industries Agroressources are those that maintain the largest number of relationships with others.

Table 7. Measurement of degree for each cluster

Cluster	Degree
Qualiméditerranée	7
Industries et agroressources	6
Agrimipinnovation	6
Plastipolis	5
Vitagora	5
Nutrition Santé Longévité	4
Trimatec	3
Axelera	3
Xylofutur	3
Fibres Grand Est	3
Céréales Vallée	2
Pôle Européen d'Innovation Fruits et Légumes	2
Vegepolys	2
Valorial	2
Enfant	1
Innoviande	1
Prodinnov	1
Pass	1
Pôle Européen de la Céramique	1

Betweenness is a measure of a node's capacity to play the role of an intermediary, a point through which information must pass. Technically, it is a node's propensity to lie on a geodesic, that is, the shortest path between two network members (Table 8).

This table shows the strategic position of some clusters within the network. The Qualiméditerranée and Agrimip clusters act as intermediaries respectively 61 and 59 times during inter-cluster collaboration. Potential inter-cluster

relationships must often go through them, as they occupy a first-class strategic position.

Table 8. Measurement of betweenness

Cluster	Betweenness
Qualiméditerranée	61.5
Agrimipinnovation	59.0
Nutrition Santé Longévité	57.5
Vitagora	51.0
Industries et agroressources	33.0
Vegepolys	32.0
Valorial	17.0
Trimatec	10.5
Plastipolis	7.5
Céréales Vallée	3.0
Enfant	0.0
Axelera	0.0
Pôle Européen d'Innovation Fruits et Légumes	0.0
Fibres Grand Est	0.0
Pôle Européen de la Céramique	0.0
Innoviande	0.0
Prodinnov	0.0
Pass	0.0
Xylofutur	0.0

The final study subject was cliques within the cluster network. Cliques are cohesive cluster subgroups that choose to collaborate with one another. Belonging to the same clique means maintaining special relationships with other clusters in the clique. In this network, 5 cliques are identified.

The cliques within the network using NetDraw:

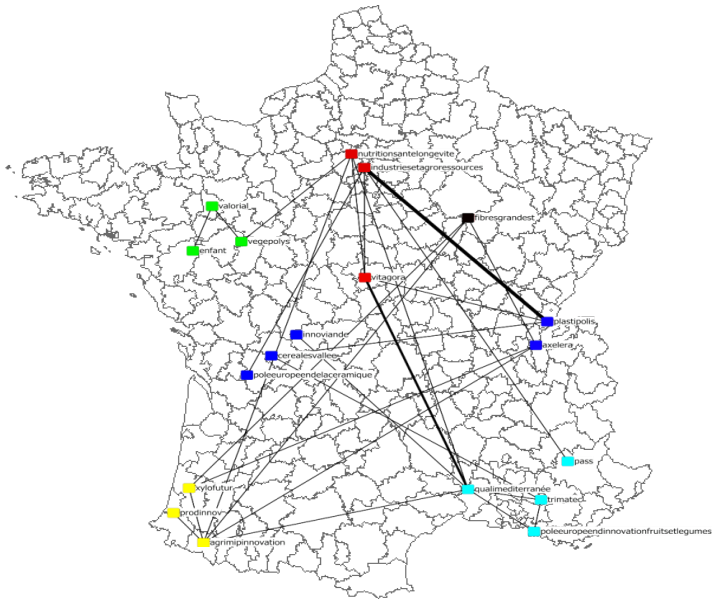
1: Agrimipinnovation ; Axelera; Fibres Grand Est ; Xylofutur
2: Agrimipinnovation ; Nutrition Santé Longévité ; Qualiméditerranée
3: Industries et agroressources ; Plastipolis ; Vitagora
4: Pôle Européen d'Innovation Fruits et Légumes ; Qualiméditerranée ; Trimatec
5: Nutrition Santé Longévité ; Qualiméditerranée ; Vitagora

Clusters with a high betweenness coefficient are also those that belong to several cliques: Agrimip (2) and Qualiméditerranée (3). These clusters have a truly strategic position within the network studied.

A final network visualisation (Figure 6), showing both the geographic distribution of clusters and the links between them, has been used to summarise the nature of their collaborations (geographical or otherwise).

Essentially there are three areas in which clusters collaborate for reasons of geographical proximity: the Northwest, Southeast and Southwest. In other areas, the collaborations observed arise instead from organised proximity, mainly technological complementarity.

Figure 6. Geographic network visualisation



This analysis reveals the general characteristics of the network of clusters, such as density and geodesics. But its main usefulness was in identifying the clusters' network positions and strategies (Table 9).

Table 9. Summary data on clusters' network positions

	Number of links	Betweenness	Belonging to one or more cliques	Nature of links	
				Geographic	Strategic
Agrimip Innovation	6	59	2	2	4
Céréales Vallée	2	3	0	0	2
Qualiméditerranée	7	61,5	3	2	5
PEIFL	2	0	1	2	0
Valorial	2	17	0	2	0
Végépolys	2	32	0	1	1

The Agrimip and Qualiméditerranée clusters play the lead role in the network. They are intermediaries in the collaborations established between clusters and not only create links for reasons of geographical proximity but also establish many strategic relations with clusters throughout France.

Other clusters, like PEIFL or Céréales Vallée, are not tightly integrated into the network. They spark few collaborations and do not occupy a strategic place within the network.

5. CONCLUSION AND DISCUSSION

This paper presents a characterisation of France's competitiveness clusters specialising in the fields of agriculture and agri-food, from which it emerges that the six clusters specifically studied have different profiles because of their proximity to dynamic areas of agricultural and agri-food production and because of their collaborations with other clusters, which have recently been encouraged by the French government.

Clearly, the Valorial and Végépolys clusters (located in the Grand-Ouest region) and the Pôle Européen d'Innovation en Fruits et Légumes (Southwest) are located in areas where there is a clear agricultural and agri-food dynamic (positive spatial autocorrelation of the units observed). These three clusters are also those with the largest catchment areas, as they are a factor in about 10% of France's employment zones. The Céréales Vallée, Agrimip Innovation and Qualiméditerranée competitiveness clusters are less clearly tied to a production dynamic. They are present in a much smaller territory (some 3.5% of the country's employment zones).

Our results presenting agri-food cluster maps show a too equalitarian geographical distribution of the competitiveness clusters to be the result of chance. What some people will call the concern for equity and others, random scattering, is clearly still an issue in the implementation of these cluster policies especially for agri-food sectors which are by nature more geographically linked to the territory and where corresponding cluster policies are not always linked to local agri-food clusters, as shown in this paper. Fontagné et al. (2010) mentioned that the government selection of the competitiveness clusters respects a rationale of an industry-area couple. They found that, based on export performance as a measure of efficiency, public authorities have managed to select the right locations of clusters in the sectors they did prioritize, hence the most promising clusters. However, even if their study was done by sector, the results could not distinguish between sectors as they introduce the type of the cluster policies ("national", "worldwide", "potentially worldwide" clusters) as the only criterion. However, as highlighted by Duranton et al. (2010) policies that encourage the development of "natural" clusters seem more promising.

The original work done has made it possible to profile distinct clusters in the agricultural and agri-food area. However, as the competitiveness clusters policy is relatively recent, it is probably too early to assess their impacts on firms' long-run performance. Martin et al (2011) in their work comparing French industrial firms that benefited from cluster policy (the French SPL program) and firms that did not; show that firms that were sustained through this policy belonged to laggard regions and declining areas. They conclude that this policy did not succeed in reversing the relative decline on productivity for the targeted firms. They also conclude that the benefits vis-à-vis the costs of clustering are extremely modest: increasing productivity by 5 per cent would require doubling the size of an existing cluster. However, their study could not identify a clear pattern in terms of which sectors cluster more and which ones gain more from clustering.

Furthermore, our analysis has been based on inter-cluster collaborations to show if some clusters are more encouraged to collaborate with each other to overcome the lack of initial agglomeration of related industries. It appears from the network analysis that some clusters are strategically positioned thanks to the kind and number of their collaborations. Such is the case of the Agrimip Innovation and Qualiméditerranée competitiveness clusters. It should be noted that in Agrimip Innovation's zone of influence, a positive spatial dynamic has emerged over the last few years in the agri-food sector. The relations developed by these clusters are characterised specifically by strategic or organised proximity, and often involve clusters with complementary activities (e.g. Agrimip Innovation and Fibres Grand Est). Those clusters, specifically the case of the Qualiméditerranée cluster, are highly encouraged by the government to develop inter-cluster collaborations. Clusters more directly linked to an agricultural or agri-food dynamic develop fewer inter-cluster collaborations and those that do exist tend to reflect mere geographical proximity.

This study however ignores international collaborations, even though the clear intent of the policy is to afford cluster members greater international visibility. Furthermore, Christensen et al. (2011) show, for the case of Danish clusters policies, that the impact of collaboration projects is higher in international collaboration projects compared to national collaboration projects. At the French level, this issue was presented as a key one by the government in January 2013, 20 of the French Competiveness Cluster will be selected to develop their international dimension, to contribute to the French attractiveness. To go further, this international dimension will have to be included in any future analysis.

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APPENDIX

Table A.1. Partner clusters of those reporting to the agriculture ministry

Competitiveness cluster	Headquarters location	Type of business
Axelera	Lyon (Rhône-Alpes)	Chemistry
Children	Cholet (Pays-de-la-Loire)	Goods and services for children
Fibres Grand Est	Épinal (Lorraine)	Bioresources / Materials
PASS	Grasse (Provence-Alpes-Côte d'Azur)	Consumer goods / Bioresources / Chemistry
Plastipolis	Bellignat (Rhône-Alpes)	Materials
Pôle européen de la céramique	Limoges (Limousin)	Consumer goods / Materials
Trimatec	Pont-Saint-Esprit (Languedoc-Roussillon)	Energy Engineering / Services
Xylofutur	Gradignan (Aquitaine)	Bioresources / Materials

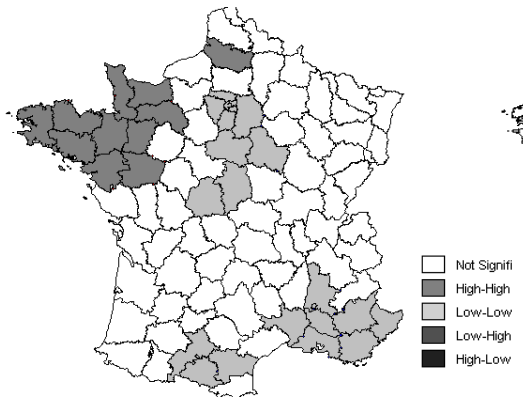

Figure A (a). Dairy production, in 1990

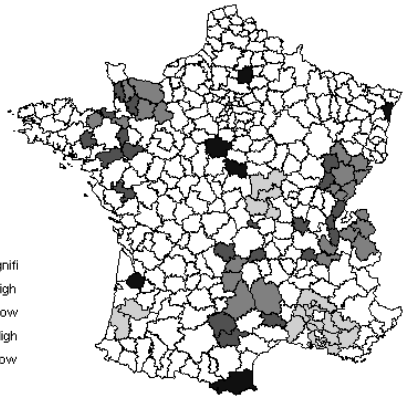

Figure A (b). Dairy industries, in 1996

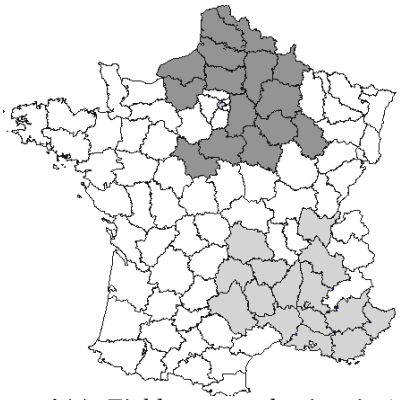

Figure A(c): Field crop production, in 1990

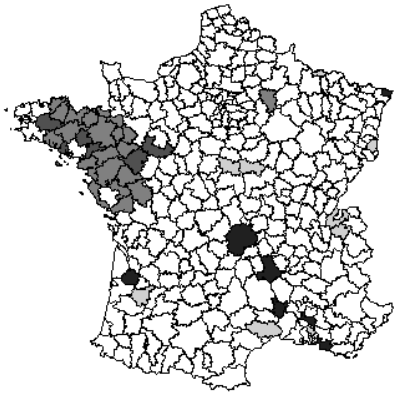

Figure A(d):. Cereal industries, in 1996

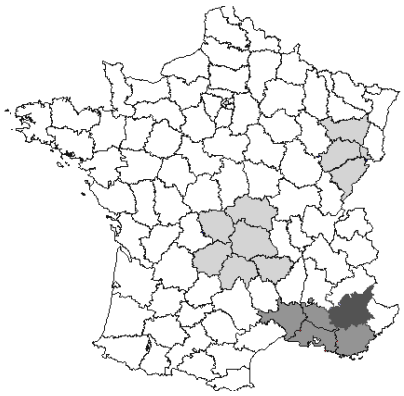

Figure A(e): Horticultural and vegetable production, in 1990

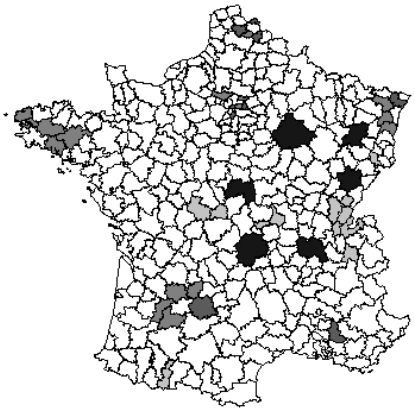

Figure A(f): Fruit and vegetable processing industries, in 1996

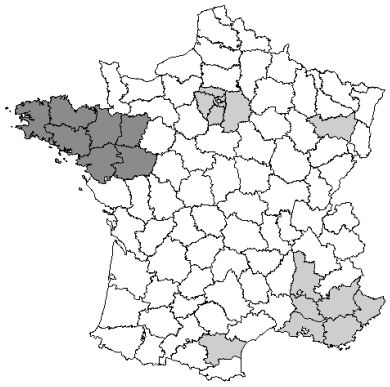

Figure A(g): Meat production, in 1990

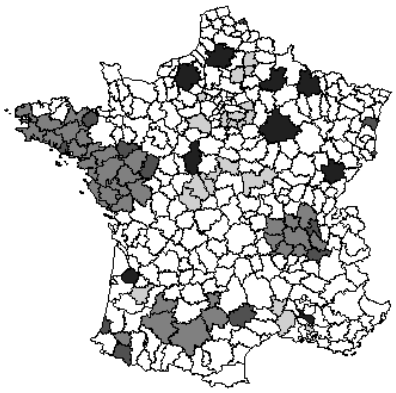

Figure A(h): Meat products industries, in 1996

Figure A(i): All IAAs, in 1996

LES PÔLES DE COMPÉTITIVITÉ AGROALIMENTAIRES : LA POLITIQUE FRANÇAISE REPOSE-T-ELLE SUR DES DYNAMIQUES SPATIALES RÉELLES ?

Résumé : *Nous analysons dans quelle mesure les pôles de compétitivité concernés par le secteur agricole et agroalimentaire reposent sur une dynamique spatiale de ces activités dans leur zone géographique d'influence. Une analyse exploratoire des données spatiales est utilisée pour détecter la structure et la dynamique spatiale des activités agricoles et agroalimentaires afin de les connecter à la localisation des pôles de compétitivité. Les résultats montrent que certains pôles ne sont pas situés au cœur des dynamiques d'agglomération des productions agricoles et agroalimentaires. Ces derniers développent spécifiquement des coopérations, souvent stratégiques, avec d'autres pôles de compétitivité.*

Mots-clés : PÔLES DE COMPÉTITIVITÉ, AGRICULTURE, INDUSTRIE AGROALIMENTAIRE