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## Identification of the local productive systems in Spain: a new approach

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**44<sup>th</sup> European Congress of the European Regional Science Association**

**Porto, 25-29 August 2004**

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**IDENTIFICATION OF THE LOCAL PRODUCTIVE SYSTEMS IN SPAIN:  
A NEW APPROACH**

**Abstract**

In the last two decades there have been significant spatial changes influenced by the industrial re-organization processes. And the studies made about these changes have defined new forms of territorial distribution. One of these new forms appears because of territorial diffusion of the economic activity due to a flexible decentralization process and, simultaneously, the endogenous development in a geographical area.

This industrial organization model has promoted the development of local geographic areas composed by a high number of small enterprises of the same industrial sector. These areas receive the denomination of local productive systems (LPS). However, these local areas can't be identified with the administrative areas in which is divided a province or a region. In fact, a LPS can be defined as a certain number of towns, near geographically, with a high concentration of the same industrial activity, but not necessary located in the same municipality.

The aim of this work is to identify and locate the LPS in the Spanish territory. So, the first phase will be to identify the industrial sectors which are highly concentrated in certain areas using the municipality which is the basic administrative unit in Spain. For that purpose it will be used indicators of the geographical concentration of the economic

activity as the Gini index and the location coefficient. Also, the use of a spatial autocorrelation index will allow us to know if the location of a concrete economic activity in a municipality is influenced by the location of the same activity in other neighbouring municipalities. With this index it will be possible to identify the industrial sectors which are highly concentrated in one territorial area that could be different from the administrative division of the territory, being an agglomeration of municipalities with a high specialization in one industrial sector.

In a second phase, the objective will be to establish the geographic areas with a high concentration level in one industrial sector. Next, we will try to delimitate the territorial boundaries in order to identify the LPS using the methodology developed by Frederic Lainé for the French case. In this methodology the characterization of the municipalities is based in four basic requirements for a concrete sector: number of establishments, employment, industrial density and specialization degree. The results, that is, the number of municipalities that fulfil these requirements, will be aggregated in order to search for the municipalities which are specialized in one industrial sector and are geographically nearby from other municipalities with the same industrial specialization.

Finally, we will obtain a new spatial unit different from the administrative units traditionally used. These new units will represent a local production systems composed of several nearby municipalities specialized in the same industrial sector. In our opinion, this new spatial unit would represent better the idea of economic unit, more accurate than the administrative-political division.

**IDENTIFICATION OF THE LOCAL PRODUCTIVE SYSTEMS IN SPAIN:**  
**A NEW APPROACH**

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## **1. Introduction**

In the last years, there have been productive reorganization processes, which are associated with important spatial changes defining new territorial organizational forms. And most studies have been concentrated on a new form that derives from a territorial process of diffusion of the economic activity based in flexible decentralization and endogenous development processes. This industrial organization model is the industrial district and it's the result of the agglomeration of a high number of small enterprises of the same industrial sector in local geographic areas.

Thereby, from the last twenty years the industrial districts and the local productive systems have been studied and discussed in the local economy field. Starting from the definition of industrial district, some authors have investigated how to identify and measure the importance of the industrial districts in the territory.

However, the delimitation of the territorial limits of the industrial districts have not been enough analysed. Most of the studies have used provincial or regional data; actually, it is more accurate to use local data. The discussions about the multiregional development in Italy in the 1970s have shown the differences in the social and economic development not only between regions, also, inside the same region or province. In consequence, it is necessary to avoid the basic identification of the industrial districts in the territory trusting in the intuition and to identify them using significative research units.

The identification of local productive systems is very important and useful to analyse the local economies. So, it can be described those highly specialized areas not based in one big enterprise. Also, the presence of a high number of specialized enterprises can be a source of local advantages for an enterprise location as the know-how, economic and

technical relationships between enterprises or the nearby to the clients. On the other hand, stressing on the local public policy, it's possible to focus the public actions on some economic sector with the aim of promoting the development of the enterprises network (training, technology transfer centres, promote of the small and medium enterprises...).

The following analysis is based in an exhaustive statistic work with the objective of identifying the agglomeration of specialized enterprises in one economic sector. This first analysis will allow us to approach to an identification of the local productive systems based in their specialization and a high density of enterprises of the same sector.

The structure of this work is divided in three parts. In the first part, we review the theory about the industrial sector as an industrial organization model based in the existence of specialized small and medium enterprises. In the second part, we present the main indicators about the spatial concentration of the economic activity and the most used methodologies in the identification of local productive systems and industrial districts. In the third part, we analyse the industrial location in Spain.

In this case, the objective is to identify the highly concentrated industrial sectors. Using local and sectorial data in Spain, we calculate the main concentration indexes for the industrial sectors. Next, it will be identified the local productive system in one of the highly spatially concentrated sectors in Spain: the footwear industry. The identification of the local productive systems will be based in the criteria used by Frédéric Lainé for the French case. With the statistical analysis the objective is to search for the agglomerations of specialized enterprises in one sector. This agglomeration must have, at least, an enough number of enterprises to be a local production system.

## **2. The territorial concentration of small and medium enterprises: the industrial district.**

The research about the industrialized local areas in the 1970's starts from the crisis of the massive production and the evidence confirming the existence of a new industrialization model based in the differentiation of the product. In those years the production

organization evolves from the integration and internal coordination inside the enterprises to another model based in the integration and external coordination (in the territory) of small and medium production units within a group of local institutions within a market system. This alternative industrial organization is the consequence of the lack of trust in the Ford model of accumulation and has produced a territorial division of the productive activity that contributes to the growth of some small and medium sized towns and also of some rural areas (Piore and Sabel, 1990).

Also, it showed how in certain regions with this new model there were some specific areas with an unusual economic dynamism and with an industrial growth rate higher than in other parts of the world. A lot of those specific areas were called "industrial districts" (Pyke and Sengenberger, 1992, 13), a theoretic concept first used at the beginning of the XX century by Alfred Marshall.

Marshall, in his classic analysis of industrial districts, shows how a group of small enterprises, concentrated in one geographical area, with the production process divided in several phases and with only one local labour market, can obtain the advantages derived from the big scale production.

Beginning from the concept of industrial district, Alfred Marshall defends the idea that the success of a national economy depends on the development of specialized industrial concentrations. So, Marshall argues how the British economic growth and its leadership during the XIX century was founded in the development of several industries, located and concentrated in concrete areas of the United Kingdom. For example, the cotton textile industry in Lancashire, the cutlery industry in Sheffield or the machinery industry in West Midlands.

The origin of the industrial specialization in a town can be the consequence of the existence of natural resources and raw materials, the nearby to the markets or, just, one "historical fact". But when the industry locates in a territory, the geographical specialization reinforces itself through location economies: the relationships between the industries and their input supplier industries, skilled and specialized workers, the development of specific machinery with the participation of the local enterprises

involved in the different phases of the production and the diffusion of knowledge and technology between the local enterprises.

To the location economy theoretic concept, Marshall adds the idea of "industrial atmosphere" inside the spatial concentration of enterprises. This industrial atmosphere does distinguish by a group of formal and informal customs, practical and traditions related with the industry and integrated in the social and cultural background of the area. The presence of this atmosphere results in advantages in production and commerce.

The recovery of the marshallian thought about the industrial district starts, basically, with the analysis carried out by Becattini about the location of small enterprises in Italy. There have been in Italy some regions with a high level of small enterprises, called the "Third Italy"<sup>1</sup>, distinguished because of their dynamism. The concentration of these enterprises results in integrated territorial systems with different degrees of sectorial specialization and with prevalence of traditional industrial sectors as textile, clothing, footwear or furniture. In these areas, the indicators as the growth rate of add value, investment, productivity and employment shows the industrial dynamism (Triglia, 1993, 216).

The contributions of Becattini in the field of industrial districts (Becattini, 1979, 1989, 1992) were developed and expanded by other authors like Bellandi (1986), Sforzi (1987, 1992), Triglia (1993) and Brusco (1992). For all of them, the idea of industrial district is widely accepted as a recovering and up to date of the marshallian concept where the main aspects are the external and the agglomeration economies. Becattini establishes the definition of industrial district as follows: a social and territorial entity characterized by the active presence of a social community and a group of enterprises located in a natural and historically established area (Becattini, 1992). Next, Becattini, more detailed, describes the elements that characterize the social community and the enterprises group. So, the social community has a homogeneous system of values and perspectives (same dialect, customs, expectations...). These values are spread through the district and through generations by the customs and the institutional system (markets, enterprises, technical schools or universities, unions, political parties, entrepreneurs associations...). Also, the relationships face to face are very common

and, this way, the people interact every day developing a common culture. In these restricted areas, appear rules of trust and mutual character (reciprocity).

In the other side, the production is organized by independent small and medium enterprises. These enterprises form a network of specialized and coordinated exchanges because of the existence of cooperation forms. The cooperation is possible due to the technical division of the production process. In this particular situation, each enterprise specializes in different phases of the production process of one or few complementary enterprises. The result is the configuration of a highly labour division. The equilibrium between competitive and cooperative principles results in the efficient coordination of the district activities and the promotion of a dynamic development. Also, the productive and social structure in a concrete geographical area is homogeneous, so, promotes the relationships and the formal and informal cooperation between the enterprises of the area, which is positive in order to obtain scale economies. Through these relationships the enterprises obtains flexibility to respond to the external changes. Of course, these relationships come up due to the reciprocity based in the confidence influenced by the local customs (entrepreneurship ethics, quality of products and services exchanged in the local markets).

Therefore, in the industrial district definition, the concentration, in a specific area, of specialized enterprises has a positive influence in the local community and gets high levels of confidence and cooperation in the industrial sector. That is the reason why the industrial districts compete with the rest of the sector's enterprises trying to offer a high level of quality and innovation.

In conclusion, the industrial district is born because of the appearance of a new concept of industry and a new way of understanding the importance of the society in the economic change process and the territory as the place where the economic forces interact. It is in the local community where appears a social and cultural environment determined by the industrial organization adopted in that society. In consequence, an industrial concentration in a geographical area is not enough to recognize the existence of an industrial district (Sforzi and Lorenzini, 2002).

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<sup>1</sup> Also called NEC (North East Middle).



In this sense, the idea that the advantages obtained from the agglomeration and external economies is not exclusive of the industrial districts. So, Porter defines "cluster" as the natural union of enterprises of a concrete sector with other industries or sector related with the main activity. This group of industries has around it a high density of support services enterprises and this situation promotes the creation of synergies, externalities, cooperation and diffusion of technology resulting in the generation of a competitive advantage.

Opposite to the cluster concept, the industrial district is characterized by a complex system of interdependences in which is configured the industrial production, the division of the labour and the relationships between the industry and its social and cultural area, that is, the relationships between the economy and the society.

In consequence, the researchers have stressed their works in the study of the relationships inside the industrial district where the information and the innovations are diffused. These works show how the innovation is produced because the agents live in a historically delimited territory and share a common culture. By sharing a culture and living, geographically speaking, nearby, they have usual and face to face relations, so they can know each other by their name. So, this is the basement of the confidence inside the industrial district that allows them to design common innovation strategies to compete in the market.

As a result, it can be observed that the elements of the territorial dynamism are not only related with the economy but with the social and cultural relations that define the community of people and enterprises.

These ideas imply that the generation of a competitive advantage depends on the relationships between the industry and its territorial context. Because of this, the competitive advantage is not the result of abstract variables like technology, markets or the economy but the consequence of the synthesis of these variables and the specific territory. In consequence, the territory's quality is the element that allows the mixture of the technology with a concrete culture, the enterprise's discovery of the appropriate environment, the transformation of competition into cooperation in the market and, finally, allows that the economic forces induce the movement and development of the

society. Thereby, the territorial dimension is recovered in the basic structure of the economic thought (Becattini and Rullani, 1996). In short, the competition not lies in the company, resides in the activity carried out by the whole industry of the area. So, if there are competitive elements in the territory, the companies will find their competitive skills.

As we have said before, the Northeast and Middle Italian industrial districts received the attention of most of the first studies but after that were extended to other countries. In this sense, we have to mention the works of researchers from several industrialized countries inside the "New Industrial Organization" programme carried out by the International Institute of Labour Studies (IILS). These works deal with a wide range of historical, theoretical, empirical, political and institutional aspects related with the industrial districts. Other works, also, had as objective to study the relevancy of the industrial district principles in order to achieve the economic development of concrete regions and the influence in the public policy. Their results would be interesting for the local administration, unions and entrepreneurship associations.

In order to complete the works above mentioned there have been a lot of contributions from the EU, OECD and research groups of North American and British universities that have extended in the field of the industrial districts, developing analysis, works and policy proposals with relevance in the international context. Summarizing, the concept of industrial district has increased the interest about to study the industrial evolution through the territory.

### **3. Methodologies for the analysis of the territorial concentration and the identification of industrial districts.**

Concerning the traditional analysis of the productive activity, a problem that appears at the first stages of a study is to use a territorial division based in the administrative division of the geographical area. The question is that the use of the administrative division as a spatial unit can't be a good election when the objective is to study an industrial organization based in a flexible specialization as the industrial district.

In this sense, it's important to highlight the interdependences between enterprises; interdependences that can be found in closer towns, inside a region or, also, in the whole country. In that sense, Sforzi shows how the industrial district has its own spatial unit. And this unit is related with the interdependences between enterprises, the enterprises and the society and these elements have influence in the towns with a high concentration of the industry. So, the industrial district can be configured as a spatial unit useful for the economic analysis.

In this line, different methodologies have been developed trying to delimitate the industrial districts in order to use it as an alternative and significative analysis unit in front of the traditional use of the industrial sector and the enterprise as main units. In this part, we review the main indexes about the concentration of the economic activity which allows to identify the highly concentrated industrial sectors in a geographical area. Next, we present the most relevant methodologies used in the identification of local productive systems and industrial districts, highlighting the methodology used by Frédéric Lainé to identify the agglomerations of specialized enterprises in France.

### **3.1. Spatial concentration indexes of the economic activity.**

The first step in order to analysis and delimitate the industrial districts is to identify the industrial sectors with a high concentration in the territory, resulting in a group of municipalities with a high weight in the total employment level of a concrete sector. These are the sectors where the conditions to determinate the existence of local productive systems or industrial districts can be found.

In the economic literature are several indexes to analyse the territorial concentration of the economic activity as the Gini index, the Hirschman-Herfindhal index, the location coefficient and the Ellison-Glaeser index. But it's important to highlight the difference in the results when these indexes are calculated in different territorial environments, so, the analysis unit may be the key when we study the dynamic of the industrial concentration.

In Spain, the results of a research confirm the exposed above (Viladecans, 2001). The results obtained using the Ellison-Glaeser index are different depending on the administrative unit used, municipality or province. In fact, the analysis shows how the

concentration of several industrial sectors -minerals, ceramic, beverages and tobacco- is higher using the municipality than the province. This situation is due to the existence of several municipalities which have a high percentage of the employment in these sectors, and when we use the province as analysis unit the importance of the municipalities is, in fact, lower.

In the empirical works about the analysis of the spatial distribution of the manufacturing activities and their location dynamics, it can find a consensus about the use of local units as the most suitable analysis unit. In some of the studies carried out in United States conclude that the state isn't the correct analysis unit because of its size. In Spain, De Lucio (1998) indicates how the analysis done using the province may be not significative because of the difference between these administrative units in size and spatial distribution of the economic activity. So, the differences between the administrative divisions used in the economic statistics are an important restriction when the objective is to use other analysis units.

In fact, the industrial district can't be restricted spatially to a region or a concrete town. In the district, all the enterprises interact with the society, and it doesn't depend on the territorial administrative division. So, the industrial district is a system of towns with a certain concentration of labour specialized in one sector. With this definition, the municipality, as administrative unit, doesn't collect the local economic area, so, it would be useful to consider a territorial unit of analysis between the municipality and the province. This way, the idea of economic unit would be represented in a better way.

One way to solve this problem would be to use the concept of local labour markets because delimitates the economic areas in relation with the movements of the workers from their homes to their works. For the Spanish case, this concept hasn't been used because the no availability of regional data.

Another option is using techniques to collect the influence of the space in the location of the industrial activities adding, in the valuation of the territorial concentration index, information of the closer geographical areas.

The indexes above mentioned describe the location of a geographical area, municipality or province without references about its spatial location and analyses the territorial units as isolated units without any connexion with its closest areas. This way, it was impossible to estimate if the employment level in a concrete area was influenced by the employment level of a nearby area, resulting in a productive area specialized in one sector.

However, it's possible to calculate indicators that reflect, in a more realistic way, the concept of a significative economic area. These indicators are the spatial autocorrelation used in the spatial econometrics. These indexes add the neighbouring areas of the municipality in order to calculate the spatial concentration of the productive activities and, therefore, allow to contrast if it's significative the influence of the neighbour areas in the territorial distribution of the activity in one municipality.

The I Moran autocorrelation statistic shows if the location of an economic variable in the territory is influenced by the existence of the same activity in neighbour areas.

The I Moran index is defined as follows:

$$IM_i = \frac{\sum_j \sum_s w_{js} (L_{ij} - \bar{L}_i)(L_{is} - \bar{L}_i)}{\sum_j (L_{ij} - \bar{L}_i)^2}$$

L: employment; i: sector; s,j: municipalities

$w_{js} = 1$  if j and s are neighbouring municipalities

$w_{js} = 0$  if j and s aren't neighbouring municipalities

A positive and significative value of the index will imply the existence of spatial autocorrelation, that is, a concentration of the analyzed sector in an agglomeration of municipalities.

Using these spatial techniques it's important to specify the concept of neighbourhood. This concept can be constructed starting from a matrix which elements,  $w_{js}$ , establish if two territories (j,s) can be considered neighbours. But there are some arbitrariness of the researcher when takes the decision about the specification of the neighbourhood criteria between different territorial units. There are some options to elaborate the matrix. One

option would be to use a binary matrix: 1 if two territorial areas share the same administrative limits and 0, otherwise. However, if the municipality is the analysis unit, there could be a problem because it can't be considered two municipalities without any shared administrative limit but the distance between them is so reduced that could be considered as closest.

In order to avoid this situation, a matrix can be constructed in a more flexible way, considering that two municipalities are neighbouring if the distance between them is lower than a fixed level. Also, can be constructed a matrix that collects the distance between several territories.

Using the first option, it will be necessary that the researcher settles down the distance to specify if the municipalities can be considered neighbours or not. If  $d_{a,b}$  is the distance in kilometres between municipalities and  $h_{a,b}$  is the matrix element defining the interaction degree between municipalities, this will take the value 1 if  $d_{a,b}$  is equal or lower than the fixed level and 0, otherwise.

It's important to highlight that the results obtained from this spatial autocorrelation index can't be understood as the same as the traditional concentration index, because they show the existence of agglomerations of several municipalities, resulting in big areas, specialized in activities in which the value is significative. For example, it's possible to find a manufacturing activity highly dispersed in the territory and with low concentration levels, but it can be found groups of specialized municipalities in that activity and, so, with a significative and high correlation index. And, in opposition, it's possible to find an industrial sector with a high spatial concentration but there is no any group of specialized municipalities, and so, the autocorrelation index won't be significative. In consequence, to analyse the industrial concentration in the territory, it is very important to consider different concentration indexes and keeping in mind that there will be different results depending on the selected index.

### **3.2. Methodologies to identify industrial districts.**

Most of the studies about the identification of local productive systems or industrial districts are based in qualitative or quantitative methods, and there are some that have

mixed both. But, in general, the methods used for quantitative studies can be used again and the results be compared. In the other hand, the qualitative studies are based in extensive knowledge about the local productive systems analysed and, that's the problem, the results can't be easily compared with other studies.

It's important to highlight that, in the different works about the local productive systems, different methodologies are used and that implies there isn't only one method that can collect all the aspects concerning the local productive systems.

About the quantitative methods, the methodologies used for the identification of the local productive systems have been classified in three categories: first, methods based in detailed information about the industrial enterprises, their location and economic data as employment; in second place, methodologies that use input-output data in order to identify the relationships between different industrial sectors and, third, methods that try to get some elements with similar statistical values in different regions using statistical techniques as the cluster analysis or factorial analysis.

Between those studies, we can highlight an approach, that uses detailed information about the enterprise, developed in the Act of April 21<sup>st</sup> of 1993 of the Ministry of Industry of Italy to identify the industrial districts; the methodology, also used in Italy, developed by the Istituto Nazionale di Statistica (Istat, 1996), the Frédéric Lainé study made in France (Lainé, 2000) or the study developed by Ybarra for the Spanish case (Ybarra, 1991).

The methodology used by the Italian Ministry of Industry is developed in the Act of the April 21<sup>st</sup> of 1993. In this Act are established two reference elements: the territorial element, that will be the local labour market, that is, an area formed by several towns with a significative employment concentration and with a low percentage of people who have to find a job in another town<sup>2</sup>; and the sectorial element, the productive sector.

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<sup>2</sup> The local labour market or system is characterized by the fact that it contains within its borders the major part of residence-to-work traffic of its population. Local labour markets can be identified through the analysis of daily movements between place of residence and place of work. For this, we will use a yardstick of regional division based on the concept of self containment. Specifically, we will utilize the analytical methodology employed in the Italian case (Istituto Nazionale di Statistica - Istituto Regionale per la Programmazione Economica, ISTAT-IRPET, 1989).

The Act exposes five necessary and enough conditions to identify an industrial district: a level of industrialization higher than the national average; a number of enterprises per citizen higher than the national average; a productive specialization in one industrial sector higher than the national average; a high level of internal specialization and, at last, a high weight of the small enterprises in the total number of enterprises.

It has to be mentioned the methodology used in Italy to identify the industrial districts developed in the “Rapporto annuale. La situazione del Paese nel 1995” (Istat, 1996, 261-268). This report uses the local labour market as territorial unit of analysis and the data from the Census of 1991. The phases in this report are the following: identification of local manufacturing systems; identification of local manufacturing systems of small and medium enterprises; identification of the main industry in each of the local manufacturing systems of small and medium enterprises and identification (as industrial district) of the local manufacturing systems of small and medium enterprises in which the main industry is formed by small and medium enterprises.

In Spain, Ybarra chooses a methodology based in the industrial district concept. In this study is used the Industrial Movement statistical base from the Ministry of Industry that collects the investments to create new enterprises or to enlarge those existing. With this statistical data, Ybarra designed a methodology to identify those economic activities in the Valencian Region with a higher dynamism than the Spanish average or those main economic activities in that region. In a second step, these economic activities are located in the territory (using the municipality as the analysis unit) and, finally, establish the weight of the small and medium enterprises in the municipalities identified in the second step.

Another methodology is developed by Lainé in his study “Agglomérations spécialisées d'établissements et systèmes localisés de production: une approche statistique”. Next, we expose the methodology used to identify the local productive systems depending on their specialization in a concrete activity.

In this study the territorial element is the employment area, that is, the geographical space where most of the people live. In France, the work done by INSEE (Institut National de la Statistique et des Etudes Économiques) jointly with the statistical



services of the Ministry of Labour established 348 employment areas in France, being the movements between home and workplace the variable of reference in order to specify the employment zones.

It is necessary to highlight that an employment area is not the same as the area where are located the specialized industrial enterprises. The area can be wide (a group of closer employment areas) or more reduced in dimension (for example, a district as the textiles-clothing in Sentier in Paris). Anyway, the employment area is in an economic area with a homogeneous level of economic activity.

In the sectorial classification used to analyse the area's specialization, a database is constructed with two sectorial classifications, one with a high level of sectorial aggregation and another with a low level. The industry's specialization in the territory can correspond to a very specific activity, while in other cases it can be developed in an area with a general activity. Because of this, it is established this double classification in order to measure more accurately the area's specialization.

To locate the specialized enterprises' agglomerations is necessary to fulfil the four requirements, below explained, to obtain a minimum level to specify that a spatial and sectorial concentration of enterprises have been identified.

The criteria are the following:

- Number of establishments: at least, five establishments of the same activity and three of them with, at least, five employees (if it is used the more aggregated sectorial classification, this requirement is stricter: at least, ten establishments in the same activity and, at least, six of them with five employees).
- Wage-earning employment: at least, one hundred wage earners in the same activity (with the aggregated classification it would be 200 wage earners in the same activity).
- Establishments' density: the establishments' density (number of establishments per km<sup>2</sup>) in the same activity and in the geographical area must be, at least, the double of the average for the French territory. This criteria is required for the sectorial establishments and, also, for the establishments with five or more wage earners).

- Specialization: the specialization weighted in function of the establishments in one sector can't be lower than the French average. With this condition the specialization index (percentage of establishments in that sector in relation with all the industrial establishments of the employment area, and in relation with the same rate in the whole French territory) can't be less than one.

By the other hand, it is considered that some part of the specialized establishments' agglomerations can't have the enough size to be a local productive system. Therefore, the author considers that one agglomeration has enough size to be a local productive system if fulfils the following conditions:

- a minimum of 20 establishments with, at least, 400 wage earners.
- 10-19 establishments with, at least, 800 wage earners.

The results of this research process show how some industries concentrate in concrete geographical locations. But it's important to highlight how the establishments statistically specified are not, automatically, part of local productive systems in the sense of enterprises agglomerations with coordination-cooperation local relationships (in production, innovation, market distribution). This is because the whole specialized enterprises of the same industrial sector can be analysed starting from another point of view as the existence of natural resources, the local know-how, the nearby to the clients. And, also, could be analysed considering that there exists in the area a big enterprise with an establishments' group around it and working for them and in many cases in an exclusive way.

In conclusion, the quantitative methods can have limitations in order to collect all the aspects concerning the local productive system. Also, these methods are based in an industrial and regional statistical classification that can not reflect the nature of the local productive system. For example, some productive systems are composed by few enterprises of different industries that include some enterprises in industrial sectors and others in services sectors. In the other hand, some productive systems are regional but others are not inside the administrative regional limits and, therefore, are not identified by quantitative methods. So, the approaches based, exclusively, in quantitative methods can not be enough to identify local productive systems. It would be necessary to use

them but including qualitative information, more detailed, and, this way, the knowledge about the real economy would be increased.

#### **4. Identification of the specialized territorial areas in Spain.**

In this part, we analyse the industrial location in Spain. Specifically, the objective is to establish the industrial sectors with a high concentration level. So, using sectorial and municipality data for the whole country, we will estimate the main concentration indexes in the several sectors studied. Next, considering the highly concentrated sectors, the aim will be to identify the local productive systems in Spain using the requirements of the Lainé's work for the French case. Finally, the territorial areas with productive specialization will be analysed in the footwear sector, one of the most concentrated sectors in Spain.

In this work, the Gini index and the location coefficient will be used in order to analyse the territorial concentration of the industrial enterprises. But the results obtained won't consider the different size of the establishments, so, in the areas where are a high weight of the small and medium enterprises (SMEs) we can obtain not enough significative results. Therefore, the Ellison-Glaeser index will be estimated because this index introduces the establishments' size as a variable and, also, establish the employment level in one area weighted in relation with the total employment level of the territory.

The sectorial classification used for the empirical analysis of the industrial concentration in Spain is the classification of the Industry Department of the Valencian Government which contains 23 manufacturing sectors.

As spatial unit, it will be used the municipality, that is, the local level (NUTS-5). Exactly, we will consider the municipalities with, at least, one industrial establishment in the analysis' period. So, the analysis will be stressed in 7001 municipalities of more than 8000 existing in Spain.

The data used to locate the industry and the industrial sectors in Spain will be obtained from the Industrial Register of the former Science and Technology Spanish Industry (now, Ministry of Industry) for the year 2000. In this register the data provide individual

information about the industrial enterprises, so, secondary variables can be generated about the number of establishments and the industrial employment in the Spanish municipalities.

As we can see in Table 1, the results of the Gini index show how the manufacturing industry is highly concentrated in Spain. The average value of this index for this industry is 89,2. The main sectors, with the highest concentration levels, are footwear, jewellery, toys manufacturing, precision instruments and optics and leather. For all these industrial sectors the Gini Index value is higher than 98,5.

The results of the location coefficient show, again, how the highest concentrated sectors are very similar to the above mentioned: footwear, toys manufacturing, leather, jewellery and the paper industry. These sectors have the spatial distribution much more concentrated than the whole industry.

Using the Ellison-Glaeser index, and so including the establishments' size, the results are consistent with the other results because the most concentrated sectors are the same as we have found with the other indexes. Therefore, we must highlight how, in Spain, the sectors with high employment concentration are composed, mainly, by small and medium enterprises.

As it has been showed before, the indexes above used describe the situation of a territorial area, the municipality, but without any consideration about its spatial location. So, the territorial units are analysed as isolated units without any connexion with nearby areas.

A further step is to calculate the spatial autocorrelation index, the I Moran index. This index adds the nearby areas to the municipality into the estimation of the spatial concentration level of the productive activities and, therefore, allows to contrast if the nearby areas must be considered. That is, this index would show the existence of municipalities' groups in the territory conforming bigger specialized areas.

To calculate this index we will add to the data base, previously used, geographical variables in order to locate the municipalities in the territory. The geographical

coordinates are provided by the Geographical Information National Centre of the Ministry of Infrastructures.

In our analysis, the geographical variables correspond to the geographical coordinates of the analysed municipalities in order to calculate the Euclidean distances between municipalities and to establish if two municipalities can be considered as neighbours. Specifically, a municipality have been considered as neighbour if the distance to the other municipality is equal or less than 25 kilometres.

The results obtained in the industrial sector using the I Moran index are showed in the Table 2 and show how the establishments' territorial distribution is more spatially correlated in the footwear, rubber and plastic, chemical industry, metal products and textiles. In consequence, the activity's concentration in these sectors is based in municipalities' groups very nearby, geographically speaking.

If the territorial distribution of the employment is analysed, the sectors with the highest value of the I Moran index are similar. In concrete, rubber and plastic, footwear, glass and ceramics, chemical industry and wooden furniture are the most spatially autocorrelated.

With these results, it is possible to distinguish several industrial sectors with a high spatial concentration but with low spatial autocorrelation levels. For example, the leather sector shows high values using the Gini index and the location coefficient; however, it has a low and not enough significative value if we use the I Moran index. So, it is possible to identify some industrial sectors with high spatial concentration value but they are not located in a group of specialized municipalities. And, also, it's possible to identify the opposite situation, that is, a sector located in a specialized municipalities' agglomeration, and therefore, with a high and significative correlation index but the activity has a low concentration level, that is, the activity is very dispersed in the territory as happens with the metallic products manufacturing.

Together wit these situations, it can be identified the existence of industrial sectors with a high concentration level and, at the same time, with a high spatial correlation index,

that is, are located in a specialized municipalities' group. The results of the calculated index show, clearly, how the footwear industry is a good example.

After the analysis of the concentration degree of the Spanish industrial sectors, the next step is to identify the territorial areas with a productive specialization. The methodology developed by Frédéric Lainé for the French case will be applied. To study the Spanish case, the analysis unit will be the municipality in order to carry out a process of territorial aggregation of the municipalities; process based in the geographical nearness approach.

Particularly, the criteria will verify a municipality for one sector are:

- Number of establishments: at least, five establishments of the same activity and three of them with, at least, five employees.
- Employment: the employment level must be higher than 100.
- Establishments' density: the establishments' density (number of establishments per km<sup>2</sup>) of the analysed sector must be higher than the double of the Spanish average not only for the group of establishments of that sector but for those enterprises with more than 5 employees.
- Specialization: the specialization weighted in function of the establishments must be higher than the Spanish average (the number of establishments in that sector in relation with all the industrial establishments in one municipality and in relation with the same rate in the whole Spanish must be higher than 1).

The municipalities that fulfil these four requirements are selected as municipalities with a significative spatial concentration and sectorial specialization. In our analysis, these municipalities will be identified as type 1.

It must be considered the criteria defined by Lainé were applied to the French employment areas composed, each one, by a concrete number of municipalities. So, these requirements could be very restrictive when are applied to the territorial level is

used here for the Spanish case, the municipality. For this reason, we will consider those municipalities that not fulfil the four requirements but verify the last two requirements (industrial density and specialization) and are located nearby of some municipalities classified as type 1. These municipalities will be identified as type 2 and show an important sectorial specialization in their territories but, however, the territorial concentration is not enough significative.

So, we have identified two types of municipalities, 1 and 2 for a concrete industrial sector. Next, we carry out a process of territorial aggregation of the municipalities that fulfil a requirement: the spatial nearness.

The Table 3 shows the results of the applied methodology. As we can see, for each industrial sector are shown the number of municipalities in which is located (municipalities with, at least, one establishment of this sector), the number of municipalities that fulfil the four requirements (municipalities type 1), the number of municipalities that fulfil the 3<sup>rd</sup> and 4<sup>th</sup> requirement and are nearby to a municipality classified as type 1 with the same productive specialization (municipalities type 2) and, finally, the number of specialized enterprises' agglomerations. The number of areas for each industrial sector is the result of the spatial representation of the type 1 and 2 municipalities in the territory.

For example, the footwear industry is located in 464 municipalities of more than 8.000 existing in Spain. In this group of 464 municipalities, only 40 fulfil the four criteria of the Lainé's methodology. There are 59 municipalities classified as type 2, therefore, there are a total of 99 municipalities with a high concentration and specialization in this sector. The geographical location of these 99 municipalities allows to identify 14 areas with productive specialization in the footwear industry (see Map 1).

So, the footwear sector is one of the most concentrated in the territory in Spain. Next, the specialized areas in this sector will be analysed in detail.

As we can see in Tables 4a-4b, the 14 areas specialized in the footwear sector have a significative proportion of the total number of establishments and employment level. Specifically, these areas have the 87,8% of the total footwear's establishments and the

89,3% of the total footwear sector's employment in Spain. Some important areas, in number of establishments, are located in Elche and Elda-Petrer, within Alicante's province in the Valencian Region. These areas are composed by 28 municipalities and concentrate more than the 50% of the total establishments and the employment of the whole Spanish footwear sector.

Also, in these areas the concentration of the footwear industry is high not only in absolute terms but in relative terms. For example, the industrial density is very high in these areas, the value is 0,697 in front of the value of 0,015 as the national average.

It is significative the highly degree of productive specialization found in these areas. In all the areas analysed for the footwear sector the percentage of establishments of this sector is the 25,75% of the total number of industrial establishments and the employment percentage is the 37,8%. In some areas, as Elda-Petrer or Villena (both also located in the province of Alicante), the employment percentage is higher than the 75% of the total.

Finally, the specialization index for all the areas is high in number of establishments and in employment and takes the value 13 for both variables. In several analysed areas this index is higher than 20 showing the highly, in relative terms, specialization in this sector.

In conclusion, the footwear sector shows a highly spatial concentration in Spain, highlighting 14 areas with significative, in absolute and relative terms, levels of number of establishments and employment for this sector.

## **5. Conclusions**

The analysis of local productive systems and industrial districts has focused the works of researchers and policy-makers since the last decades. In several works the objective was to identify these local productive systems and industrial districts in the territory. Most of these studies about the territory are based in quantitative or qualitative methods and there are some works that use both approaches.



In general, the methods developed in those quantitative works can be used again and compare the results. The qualitative approaches are based in an extensive knowledge about the local productive systems analysed and, that's the problem, the results can't be easily compared with other studies. Anyway, the different researches about the identification of local productive systems develop their own methodologies suggesting there's no an only methodology to work in this field.

In this work, the identification of the local productive systems in Spain has been done using the methodology applied in France by Frédéric Lainé. To locate the agglomerations of specialized enterprises four requirements must be fulfilled by the area in order to establish its specialization level.

As a first step, the Gini Index and the location coefficient have been measured in order to analyse the industrial concentration in Spain and the results show how the industry is highly concentrated in the Spanish territory, specially, the footwear, toys, leather and jewellery industries which are the most concentrated sectors.

The I Moran index allows to identify how the concentration of the footwear, rubber and plastics, glass and ceramics and chemical sectors' activity is based in groups of specialized municipalities geographically very nearness. So, the concentration of these sectors doesn't appear in an isolated municipality but in a group of them.

The identification of the local productive systems in Spain through the Lainé's methodology has allowed to find the areas where the different industrial sectors are concentrated in the territory. Specifically, in the footwear industry 14 areas with productive specialization in this sector have been identified. These areas are located in ten Spanish provinces (Alicante, Murcia, Albacete, Baleares, La Rioja, Castellón, Toledo, Huelva, Zaragoza and Valencia). The importances of these areas are based in the two main variables: number of establishments and employment level. And, also, the productive specialization found in these areas is very high.

Alicante, in the Valencian Region, is the province where the footwear sector's concentration is the highest. Inside this province have been identified 3 areas (Elche,

Elda-Petrer and Villena). More than the half of the establishments and the total employment of the Spanish footwear industry are located within these three areas.

In conclusion, we have tried to identify the local productive systems in Spain using the specialization as the reference variable. The results show the areas where the footwear industry is highly concentrated. However, it is important to highlight that the finding of establishments' groups using statistical requirements is not enough to confirm the existence of local systems of production in the sense of the presence of enterprises' agglomerations cooperating and coordinating between them in issues as production, innovation or commercial distribution as we can find in the industrial district. Therefore, the approaches based, exclusively, in quantitative methodologies can't be enough to identify and analyse the local productive systems or industrial districts. The methodology would consist in the combination of quantitative information with more detailed qualitative information in order to reach a better understanding of these forms of industrial organization.

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**Table 1: Spatial concentration indexes (employment as variable)**

MANUFACTURING SECTOR	GINI	Rank	LOCATION COEFFICIENT	Rank	ELLISON- GLAESER	Rank
Construction materials	91,1	21	46,9	14	0,004	15
Natural stone	93,8	18	53,6	12	0,006	9
Glass and ceramics	97,9	8	61,4	6	0,011	7
Chemical industry	97,0	13	45,4	16	0,003	17
Manufacturing of metal products	91,7	20	26,9	23	0,001	23
Machinery and mechanical equipment	96,0	16	35,1	22	0,002	20
Machinery and electrical-electronic material	97,9	7	49,0	13	0,005	11
Transportation equipment	98,5	6	55,1	10	0,002	19
Precision instruments and optics	99,0	4	56,7	9	0,019	6
Food industry	87,0	23	39,2	21	0,002	18
Beverages and tobacco	97,0	12	59,4	8	0,006	10
Textiles	96,7	14	60,0	7	0,011	8
Leather	98,7	5	68,6	3	0,022	4
Footwear	99,4	1	85,3	1	0,087	1
Clothing	93,8	19	54,3	11	0,005	12
Wood	87,4	22	42,7	19	0,004	14
Wooden furniture	94,7	17	44,8	17	0,004	16
Paper	97,8	9	64,0	5	0,005	13
Graphic arts and publishing	97,7	10	42,3	20	0,021	5
Rubber and plastic	96,2	15	42,9	18	0,002	21
Jewellery	99,4	2	66,2	4	0,045	2
Toys	99,2	3	69,4	2	0,037	3
Other manufacturing industries	97,4	11	46,3	15	0,001	22
Manufacturing industry (Average)	89,2		52,8		0,013	

**Table 2: Spatial autocorrelation index (I-Moran index).**

	NUMBER OF ESTABLISHMENTS			EMPLOYMENT		
	I-MORAN		Rank	I-MORAN		Rk
MANUFACTURING SECTOR						
Construction materials	0,057	**	15	0,051	**	17
Natural stone	0,074	**	12	0,071	**	15
Glass and ceramics	0,083	**	11	0,228	**	3
Chemical industry	0,145	**	3	0,218	**	4
Manufacturing of metal products	0,139	**	4	0,189	**	6
Machinery and mechanical equipment	0,110	**	10	0,175	**	7
Machinery and electrical-electronic material	0,036	**	20	0,090	**	10
Transportation equipment	0,117	**	9	0,037	**	20
Precision instruments and optics	-0,016		22	0,072	**	14
Food industry	0,047	**	17	0,079	**	12
Beverages and tobacco	0,046	**	18	0,044	**	18
Textiles	0,138	**	5	0,171	**	8
Leather	0,045	*	19	0,039	*	19
Footwear	0,244	**	1	0,239	**	2
Clothing	0,026	*	21	0,022	*	22
Wood	0,072	**	13	0,123	**	9
Wooden furniture	0,135	**	6	0,207	**	5
Paper	0,130	**	7	0,029	*	21
Graphic arts and publishing	0,050	**	16	0,075	**	13
Rubber and plastic	0,217	**	2	0,269	**	1
Jewellery	-0,024		23	-0,020		23
Toys	0,124	**	8	0,089	**	11
Other manufacturing industries	0,061	**	14	0,055	**	16
Manufacturing industry (Average)	0,089	**		0,111		

Note:

\*\* Significance level less than 0,01

\* Significance level less than 0,05

**Table 3: Results for the identification of specialized territorial areas.**

MANUFACTURING SECTOR	N° OF MUNICIPALITIES (*)	CRITERIA VERIFICATION		(a) + (b)	ESTIMATED AREAS
		(a) ALL (1,2,3,4) (TYPE 1)	(b) ONLY 3,4 AND PROXIMITY (**) (TYPE 2)		
Construction materials	2421	51	248	299	24
Natural stone	1557	11	22	33	6
Glass and ceramics	1099	35	132	167	14
Chemical industry	1440	82	200	282	24
Manufacturing of metal products	5004	219	252	471	33
Machinery and mechanical equipment	2504	142	241	383	22
Machinery and electrical-electronic material	1266	68	162	230	25
Transportation equipment	1677	47	155	202	20
Precision instruments and optics	489	14	52	66	9
Food industry	6292	122	218	340	43
Beverages and tobacco	1712	10	37	47	8
Textiles	1400	77	190	267	12
Leather	543	17	54	71	9
Footwear	464	40	59	99	14
Clothing	1856	85	246	331	33
Wood	4430	76	308	384	29
Wooden furniture	2291	106	242	348	30
Paper	618	24	131	155	8
Graphic arts and publishing	1348	64	101	165	29
Rubber and plastic	1613	90	209	299	12
Jewellery	399	11	23	34	10
Toys	304	6	28	34	4
Other manufacturing industries	802	11	83	94	8

Note:

(\*) Municipalities where, at least, exists one establishment of that industrial sector

(\*\*) Less than 25 kilometres of a municipality type 1

**Table 4.a: Results for the footwear industry areas (number of establishments)**

AREA Centre (Province)	Number of municipalities	INDUSTRY		FOOTWEAR				
		Absolute values	% on the national value	Absolute values	% on the national value	Industrial density	Internal specialization	Specialization index
		(a)	(b)	(c)	(d)	(c) / Surface	(c)/(a) (%)	(d)/(b)
Elche (Alicante)	21	5614	1,49	2332	31,7	1,925	41,5	21,2
Elda-Petrer (Alicante)	7	2672	0,71	1461	19,9	2,578	54,7	27,9
Villena (Alicante)	5	1869	0,50	550	7,5	0,496	29,4	15,0
Illueca (Zaragoza)	15	8001	2,13	491	6,7	0,298	6,1	3,1
Inca (Balears)	13	1268	0,34	324	4,4	0,418	25,6	13,0
Almansa (Albacete)	4	642	0,17	322	4,4	0,329	50,2	25,6
Arnedo (Logroño)	14	1840	0,49	260	3,5	0,422	14,1	7,2
Fuensalida (Toledo)	6	436	0,12	183	2,5	0,555	42,0	21,4
Ciutadella (Balears)	4	681	0,18	164	2,2	0,417	24,1	12,3
Caravaca (Murcia)	3	791	0,21	149	2,0	0,119	18,8	9,6
Vall d'Uxo (Castellón)	5	553	0,15	132	1,8	1,310	23,9	12,2
Valverde del Camino (Huelva)	1	143	0,04	64	0,9	0,293	44,8	22,9
Torrent (Valencia)	1	628	0,17	28	0,4	0,404	4,5	2,3
Total of Areas	99	25138	6,69	6460	87,8	0,697	25,7	13,1
Other municipalities	365	350397	93,31	895	12,2	0,002	0,3	0,1
Total of Spain	464	375535	100,00	7355	100,0	0,015	2,0	1,0

Note: Areas ranked according to the number of establishments of the footwear industry.



**Table 4.b: Results for the footwear industry areas (employment)**

AREA Centre (Province)	INDUSTRY		FOOTWEAR				
	Absolute values	% on the national value	Absolute values	% on the national value	Industrial density	Internal specialization	Specialization index
	(a)	(b)	(c)	(d)	(c) / Surface	(c)/(a) (%)	(d)/(b)
Elche (Alicante)	55851	1,60	29991	30,4	24,761	53,7	19,0
Elda-Petrer (Alicante)	27892	0,80	21136	21,5	37,300	75,8	26,8
Villena (Alicante)	9298	0,48	7015	7,1	6,326	75,4	14,9
Illueca (Zaragoza)	67808	1,95	5404	5,5	3,283	8,0	2,8
Inca (Balears)	9992	0,29	6247	6,3	8,068	62,5	22,1
Almansa (Albacete)	8078	0,23	5575	5,7	5,701	69,0	24,4
Arnedo (Logroño)	21324	0,61	4412	4,5	7,163	20,7	7,3
Fuensalida (Toledo)	3828	0,11	2341	2,4	7,097	61,2	21,6
Ciutadella (Balears)	4282	0,12	2235	2,3	5,676	52,2	18,5
Caravaca (Murcia)	6094	0,17	1243	1,3	0,992	20,4	7,2
Vall d'Uxo (Castellón)	3639	0,10	1398	1,4	13,877	38,4	13,6
Valverde del Camino (Huelva)	828	0,02	542	0,6	2,479	65,5	23,1
Torrent (Valencia)	6075	0,17	397	0,4	5,727	6,5	2,3
Total of Areas	232361	6,67	87936	89,3	9,491	37,8	13,4
Other municipalities	3250314	93,33	10589	10,7	0,022	0,3	0,1
Total of Spain	3482675	100,00	98525	100,0	0,200	2,8	1,0

Note: Areas ranked according to the number of establishments of the footwear industry.

**Map 1: Footwear industry areas in Spain.**

