INTEGRAL ANALYSIS OF THE CERAMIC CLUSTER OF CASTELLON

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0 INTRODUCTION

Justification

It would not be irrational to say that the tile sector is the business lung of the province of Castellón. From this arises precisely my personal interest in examining the tile industry and gaining a deeper knowledge of it, given the importance and relevance it may have for my professional career.

The idea of the Castellón tile cluster has been studied and analyzed in several previous works, both by other colleagues from the Jaume I University (UJI) and other institutions. What surprised me was to find myself with very theoretical and conceptual or repetitive studies in the analyzes and conclusions throughout the chapters. Thus, I have found the opportunity to carry out a study that intends to include all the activities of the sector, from the technical and statistical parts such as the production process, logistics or economic performance to the artistic and creative part with the analysis of the stylistic and promotional part of Castellón's pottery.

Objectives

The general purpose of the project is, on one hand, to lay the foundations for a better understanding of what the Castellón tile cluster is, composition and operation; and, on the other hand, to make a precise diagnosis on the economic situation which the sector is currently in, contrasting historical data.

Thus, we can enumerate the following objectives:

- To have a better understanding about the concept of industrial cluster and its possible variations and to expose the main characteristics of the ceramic cluster of Castellón.

- To outline the ceramic production process, illustrating the peculiarities of each stage, identifying the main actors (companies) and studying the evolution of the economic activity of the business fabric.

- Identify the different typologies of the final product that we can obtain, the stylistic trends of the moment and the promotional model.

- Study the commercial evolution of the sector, through the analysis of different economic indicators.

- Identify the main international logistics routes of the cluster by seaway and analyze the "Mediterranean Corridor" project; possible impact and the state of negotiations.

Structure

In order to cover such different subjects without ever losing sight of the overall objective of the study, I have divided the work into three main parts. The first part includes the conceptual part, where we analyze the industrial cluster phenomenon and his characteristics, the value chain and the productive process. As for the second part, we focus on the study of a practical chase, the Spanish ceramic cluster, and this part includes local culture, economical background, public actors, product, promotion, sale and logistics process.

1 THE CONCEPT OF INDUSTRIAL CLUSTER

1.1 Introduction

One of the most remarkable attributes regarding today's market, compared to past times, is the commercial opening of most of the world; globalization. It is a time characterized by an exponential increase of the movement of products, people, monetary transactions, knowledge, services, etc. This is what causes economic competition to be high.

Governments are aware of this phenomenon and know that, for social welfare to exist, they have to worry about the results of their economic agents. The idea is that, in a globalized world, if one operates on its own, there is very little maneuvering power and hence the emergence, especially in the last half century, of political alliances between different institutions and organizations throughout the world, in order to achieve positions of power and access to strategic resources that guarantee sustainable economic growth and, therefore, social welfare.

As it occurs in politics as well as in the business world, which from my point of view is the same, the bigger you are then the more power you have. If one cannot carry out a deal by oneself, then he/she makes alliances and strategic collaborations. This is the case of industrial clusters, which are allied companies whose purpose is to complement each other in order to obtain a highly positive result that can be shared between the members of the alliance. The collaboration grants the participants costs decreases and, therefore, an improvement in production and competition. This is achieved because fixed costs, like for example infrastructure, are shared between all the participants, therefore this allows resource access and exclusive capacities which improve the market's competitiveness.

Therefore, we will adopt Porter's definition that understands industrial cluster as a geographical proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and externalities (Porter, 1990).

1.2 Characteristics

Typologies

There are different types of conglomerates depending on its characteristics. A consensus in academic literature claims that economic clusters can be classified into four groups: geographical, sectorial, horizontal or vertical.

- Geographical clusters are those that, as the term suggests, are found geographically close, which benefits the collaboration and the exchange of elements between the different companies, or in the case that climate or culture is a necessity or competitive advantage.

- Regarding sectorial clusters, we find companies operating together within the same sector. It is important to acknowledge the existent difference between industry and sector. Unlike industries, which are characterized by performing similar activities in order to obtain or cover a particular need, sectors are groups of companies that, not necessarily carrying out the same activities, manage to meet the same needs. A good example could be the one of two companies belonging to different industries, like for example a football club and a film producer, that are competing within the same sector, the entertainment. Regarding sectorial clusters, we can highlight the one of the English navy, where naval activities are complemented in two main areas of the south-east of the English peninsula, Cowes and Solent.

- On the other hand, horizontal clusters are those that interconnect organizations from different economic areas that are characterized by the need of sharing the same resource. In general terms, this is the most common case since we can identify most organizations as needing energy resources, although to be more accurate, this is also the case of the "knowledge management". A notable example is, from my personal experience, the political cluster of Hague. It is a central city in the world's politics, mainly because of the presence of The International Court of Justice. This implies that there must be an enormous amount of diplomatic, security, legal or translation and interpretation services for the proper functioning of these activities.

- Finally, the vertical clusters are those in which we find actors from all the stages of the value chain or productive process of a particular activity. This is the case of the tile industry from Castellón, although it could also be classified as geographical cluster. It is a cluster that covers, in a reduced geographical area, an approximately 30 kilometers radius. There are companies that work obtaining the raw material, as a first step, to the product's final design or promotion and sale.

Competitive advantages

Regarding the competitive advantages that this collaboration could provide, we have to highlight the following:

- High-Tech: some clusters can have a highly advanced technological nature, as it is the case of Silicon Valley, which causes that the companies interested in developing certain activities need to make a high investment in order to obtain the necessary technological infrastructure. This influences the initial fixed costs and, therefore, it can establish a great entrance barrier for the industry. Regarding clusters, such high fixed costs that imply seizing this technology, can be divided between the several participants of the industry and, therefore, making the investment and activity of these companies viable. Belonging to a cluster that have that technology needed in order to carry out the economic activity makes up a great competitive advantage compared to those companies that are not involved in a cluster and, hence, they have to stand the technology's high costs by themselves.

- Historical know-how based: another distinguished feature that can be classified as a competitive advantage for the companies involved in a cluster is skill. These are cases in which a particular society, due to different historical factors, is characterized by having developed an activity for a long time and be endowed with experience, professionalism and reputation in that field. The case that concerns us, the tile sector of Castellón, can be a good example of this type. We can consult in historical books and documents that, although the greatest boom of the industry has occurred in the last half century, due mainly to the opening of the Spanish market to Europe and to the rest of the world, we have evidence that the people of Castellón began their creation of a factory of earthenware in the town of Alcora since the 18th century. This long period of time has allowed them to take risks, to innovate and to make mistakes and learn from them and from there arises the competitive advantage of the Spanish tile industry compared to others, the knowledge and skill both in production and in the management of these companies and in the creation of an economic framework favorable to their progress. However, we have to highlight that another huge benefit to the cluster is the ability to have very large and well-qualified and experienced workforce in these activities, which obviously will have a very positive impact on the productivity and performance of this industry.

- Factor endowment: This is a feature that all industries have to a greater or lesser extent. In this case I would like to emphasize the case of the Chinese tile industry as a great beneficiary of a large amount of capital for the development of its industry. We highlight that even if China is a capitalist republic, the state has the ability to intervene directly in the economy. One of its main features is that it is an interventionist state that tries to control its industry from politics. This is what brings them an enormous amount of capital for the boom and expansion of their sectors and strategic activities, thus assuming a great market power and a guarantee in the fact that, despite the commercial results, the industry will always be supported by the state for its progress.

- Low-cost manufacturing of knowledge services: This is the case of those clusters that emerge in certain regions due mainly to low labor, energy or political costs, which clearly brings a great advantage when competing in the price war market. As in the previous example, we could also highlight here the Chinese industry as a competitor that benefits from relatively low costs compared to its Italian or Spanish competitors in the world market.

- Knowledge services cluster: Finally, we discuss the case of those industries that are characterized by having at their disposal technical or business services of very high quality at a moderate cost. These are industries that have a very strong institutional and educational framework and a high degree of knowledge of the activity that allows them to have at their disposal those services that may not be fundamental to the value chain of the product, but are of a high consideration for the consumer (for example an aesthetic advice) or a key process for productivity (for example administrative or personnel management). (Stephan Manning, 2012)

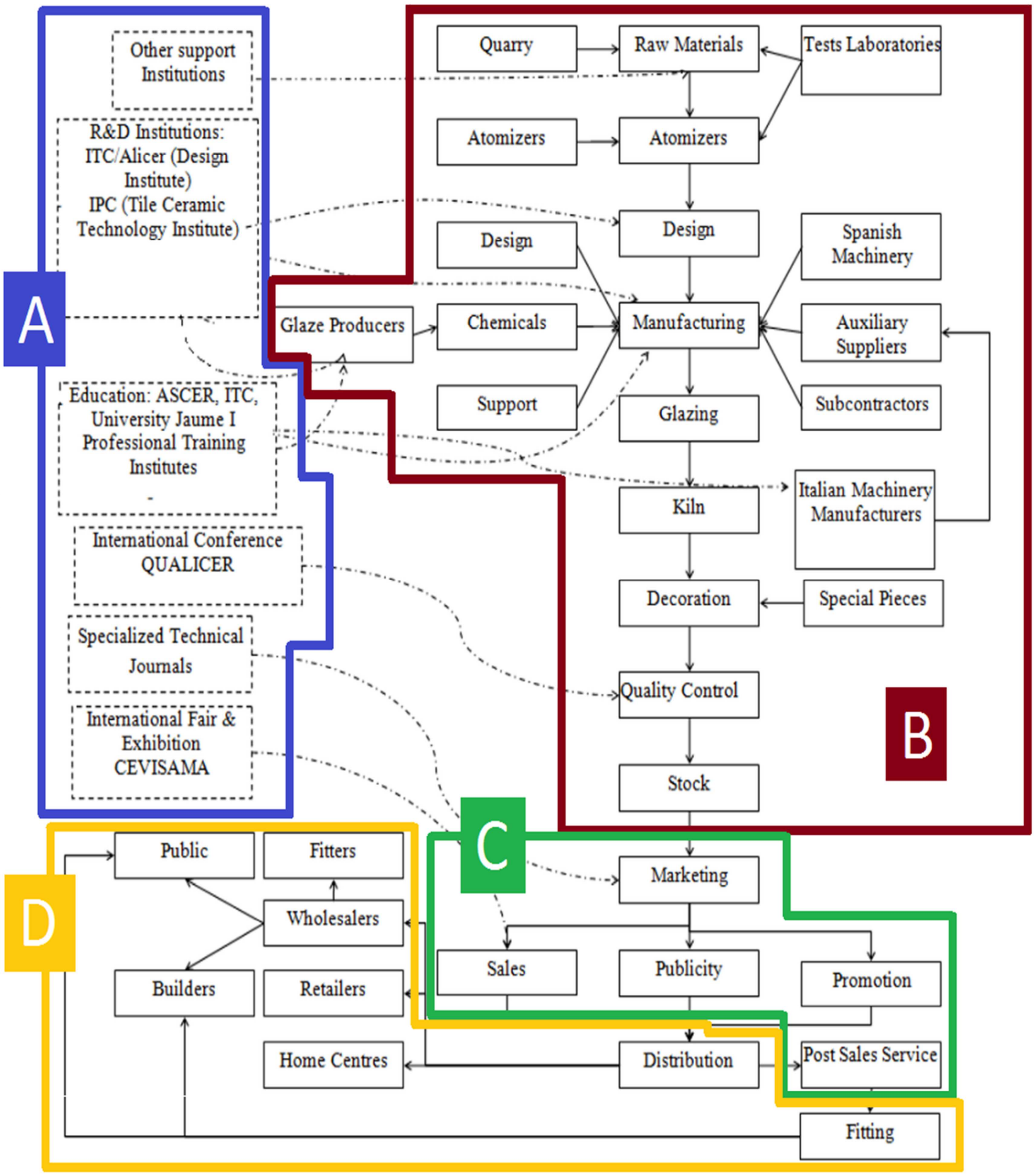
As we have already noted, competitive advantages can be of various types, depending on historical, cultural, economic, social, political, geographical, etc. factors. What we are interested in now is to get an idea of the potential benefit that participation in a cluster can mean for both the industry and the participating companies as well as for society as a whole.

Therefore, we can conclude that, in the province of Castellón, we are facing a tile industrial cluster. This is due to the high ratio of exports and sales together with the fact of greater vertical integration as there are more and more companies producing semi-processed goods whose customers are located inside the district. This cluster can be classified as both geographic, because it is in a relatively concentrated area and vertical, because it has, to a very high extent, companies dedicated to each of the productive stages or the value chain, which we will discuss later. On the other hand, it is characterized by having the competitive advantage of the know-how, having a wide history in the accomplishment of this type of activities and also, in the background, knowledge of services, for having a rich variety of services that efficiently complement the business activity.

1.3 Ceramics value chain

I consider it convenient to present the value chain of the sector to give the reader a better general outline of the composition of the sector. Thus I have grouped the different activities according to their nature to facilitate the best understanding of the reader on the topic addressed in each of the following chapters.

Illustration 1. Ceramic cluster global composition



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As it can be seen, we are faced with four major groups: Institutions, Production Process, Marketing and Logistics. Following this scheme, the topics will be discussed in the following chapters:

B: Production process (Following subchapter)

A: Public actors (Chapter 2.1)

C: Marketing (Chapter 2.2)

D: Logistics (Chapter 2.3)

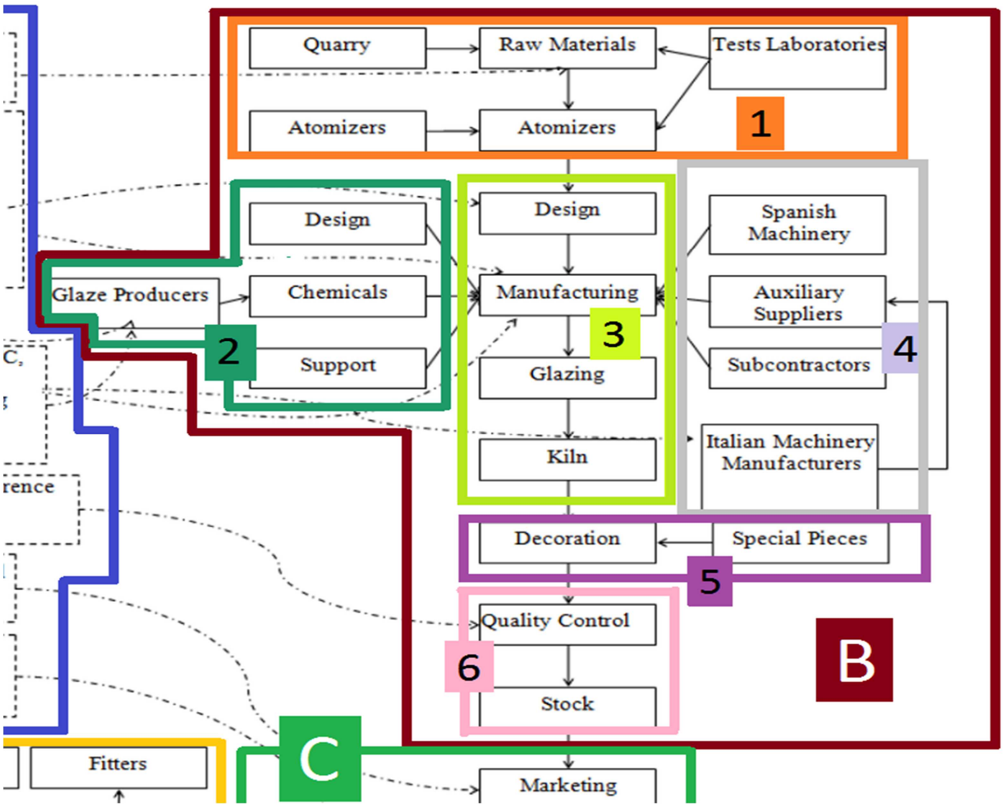
1.4. Production

As shown above in the value chain diagram, there are several sequential steps through which the raw material has to pass, not forgetting its own extraction that also involves an expensive activity, until you get the desired product ready for its sale. In this chapter will make a complete sequential scheme of the production process where the peculiarities and characteristics of those companies belonging to that stage will be analyzed and, finally, an analysis of the historical performance of the industry will be carried out.

The manufacturing process that requires the participation of various industrial activities. Thus, as detailed below, the global ceramic activity includes, in addition to the tile manufacturers, the industries that supply raw materials (ceramic clays and enamels), industrial machinery, other auxiliary industries and manufacturers of the final product.

In sight of our value chain scheme, the classification would be as follows:

Illustration 2. Productive process composition on the value chain



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Extractive and atomizing industries

Stone clay

It is the group composed of the actors responsible for obtaining and treating the raw material, this being the clay, so that it is ready for the technical processes to which it will be subjected in the following stages.

This can present various colors according to the impurities that it contains, that go from the orange red to the white when it reaches its maximum state of purity. The most commonly used clay (70%) is red and proceeds in equal parts of mines located in the DIC and in other border areas (150 km). The remaining used clays are white and arrive mostly by sea from Ukraine and Turkey. Historically the presence of clay mines in the district itself has been an important competitive advantage, and one of the reasons for the location of the ceramic industry in the DIC area.

The initial treatment consists of several steps whose purpose is to get rid of the impurities and give the appropriate form to be able to transport and work later.

Atomization of clay

First, the extracted mass is subjected to a sieving process where the thickest particles are disposed of. Subsequently, the washing is carried out where the impurities are removed and the grinding of the degreasers is carried out. Finally, it undergoes mixing and kneading and scraping processes in order to achieve homogenization of the material.

The treatment of clays requires large installations and important energy consumption. This fact has motivated, on one hand, the creation of spray companies jointly between several manufacturers of tiles or, on the other hand, incorporated the atomization plant of clays or accompanied by the implementation of the technology of electrical cogeneration, that allows to make the most of the heat released by the tile firing furnace for the production of electricity and particularly for use in the atomization unit.

Some of the main companies dedicated to this activity in the Spanish cluster are: AZULIBER 1 SL, NUEVOS PRODUCTOS CERAMICOS SA, EUROATOMIZADO SA, ARCILLA BLANCA SA, TIERRA ATOMIZADA SA, NUEVAS ATOMIZADAS SL

Frits, Enamels and Ceramic Colors

Frits are the main component of almost all ceramic enamels. It is a vitreous material that results from a process of melting the mixture of raw materials at high temperature.

The design refers to various issues such as drawing, gloss, color, and others such as roughness, porosity and size of the pieces.

Together with its strictly productive role as a supplier of raw materials, it is responsible for a large part of the innovation and creation of ceramic design component, assuming the main focus of investment in A I+D+I of the sector and assuming the differential element in terms of design and final quality of ceramic tiles and pavements.

Frits, enamels and ceramic colors

The economic relations with other companies of the sector are limited to the supply of special pieces, and to the sporadic subcontracting of some pieces in conjuncture peaks of demand.

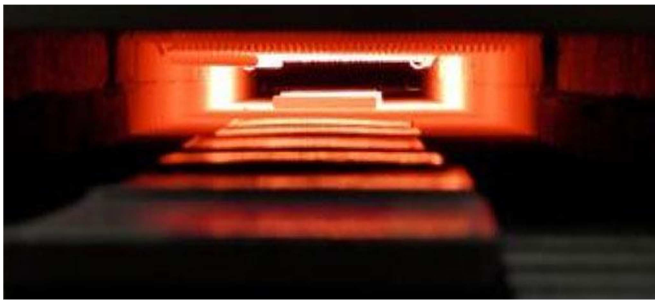
In this field the following companies stand out: FERRO SPAIN SA, ESMALGLASS SA, VIDRES SA, COLORONDA SL, INNOVACIONES TECNICAS APLICADAS A CERAMICAS AVANZADAS SA, CERFRIT SA, etc.

Ceramic Flooring Companies

They are at the center of the production process, using the atomizers, enamels, and special parts to produce the final product before its decoration and quality testing.

The main process to which the product is subjected is Molding. The purpose is to decrease the amount of water kneaded to work with a paste more dry or less plastic. There are two types of models; by press and by filtering. The first is used for dry pasta and is optimal for the manufacture of flat tiles while casting uses a liquid clay paste called slip and is used for the production of certain products of earthenware, stoneware or porcelain such as toilets, sinks, bidets, etc.).

It is then subjected to drying where a large part of the previously kneaded water is gradually and progressively removed and as the last step is subjected to cooking. This can be done in two ways; through discontinuous furnaces and continuous furnaces. The difference lies in the fact that in discontinuous furnaces the temperature varies throughout the procedure while, in the continuous furnaces, as the name itself indicates, a constant temperature is maintained. The manufacture can be made according to two processes; bicooking and monocooking and depending on if the products slide through the productive chain or the fire advances meeting with the static products, we talk about tunnel ovens or Hoffman furnaces respectively.


Laser oven

However, depending on the product that we want to obtain we can make slight variations in the process. In the case of glazed ceramics, it is subjected to a higher than normal temperature to allow vitrification of this. The other special case is that of the tiles, whose particularity is the presence of a clay support called cake and the vitreous coating that is practiced by means of ceramic enamel.

The main companies of this stage are: PAMESA CERAMICA SL, PORCELANOSA SA, CERAMICA NULENSE SA, VENIS SA, KERABEN GRUP SA, CERAMICA SALONI SA, HALCON CERAMICAS SA, GRESPANIA SA, MARAZZI IBERIA SL, PERONDA CERAMICAS SA, BESTILE SL, CICOGRES SA, etc.

Construction machinery

This sector, as its name indicates, is responsible for designing and manufacturing the necessary machinery (presses, printers, furnaces, etc.) for the correct operation of the production process. It is the weakest part of the ceramic industry of Castellón, with most of this being imported from Italy

We highlight: KERAJET SA, SYSTEM ESPAÑA SA,

Auxiliary companies, special parts and third fire

As in any economic activity, there are both essential and optional processes, that is, depending on the characteristics and nature of the final result that we are looking for, there are stages that can be suppressed or not, and this is the case of the pieces, which according to desired result we may need them or not.

Examples of auxiliary industry are: companies in charge of the preparation and installation of exhibitors, storage, manufacture of packaging, services to companies, transport, etc.

Some of the most prominent names in the sector are: THESIZE SURFACES SL, QUIMIALMEL SA, C F M MINERALES S.A

2. THE CERAMIC DISTRICT OF CASTELLÓN

2.1 Introduction

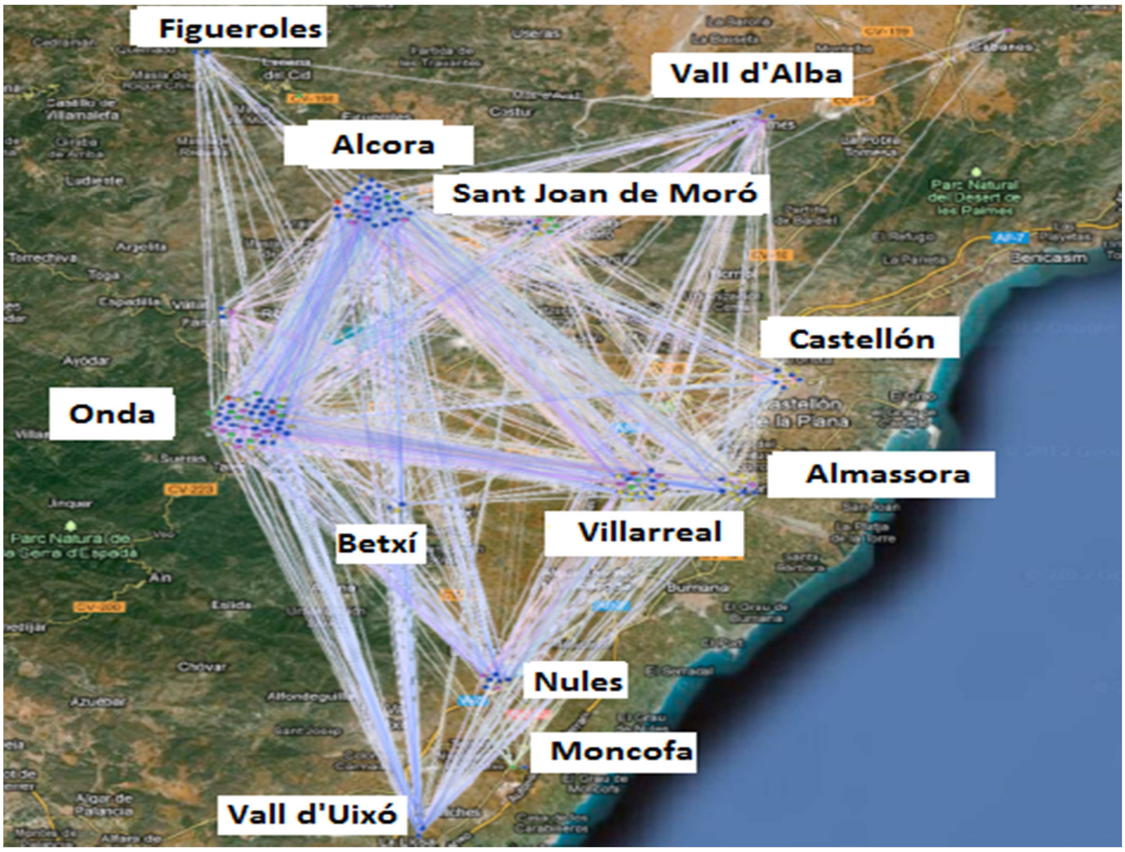
2.1.1 History and localization

One of the main characteristics of the Spanish tile industry is the high geographical concentration of the industry in the province of Castellón, especially in the area bounded to the north by Alcora and Borriol, to the west by Onda, to the south by Nules and to the east by Castellón De la Plana in a radius of about 30 kilometers, located on the Mediterranean slope and composed of 25 municipalities that make up an urban area of about 250,000 inhabitants, and where almost all tile manufacture of Spain is concentrated.

The history of Castellón's ceramic goes back to the 18th century with the creation of the first ceramic factory in the village of Alcora. Among the reasons for this industry's creation in this area, the availability of clay quarries in the vicinity of the city and the existence of potters from areas of artistic influence at that time, such as France or Italy, stand out. This phenomenon soon was reflected in the neighboring towns due to the abandonment of old workers who created their own workshops, imitating the techniques and designs. Thus, we discover the foundation of another workshop in 1778 in Onda, which was in charge of the ceramist Miguel Guinot, or the foundation of Jose Ferrer at the end of the century in the town of Ribesalbes.

Therefore, nowadays, the ceramic network of Castellón is as following:

Illustration 3. Ceramic cluster network

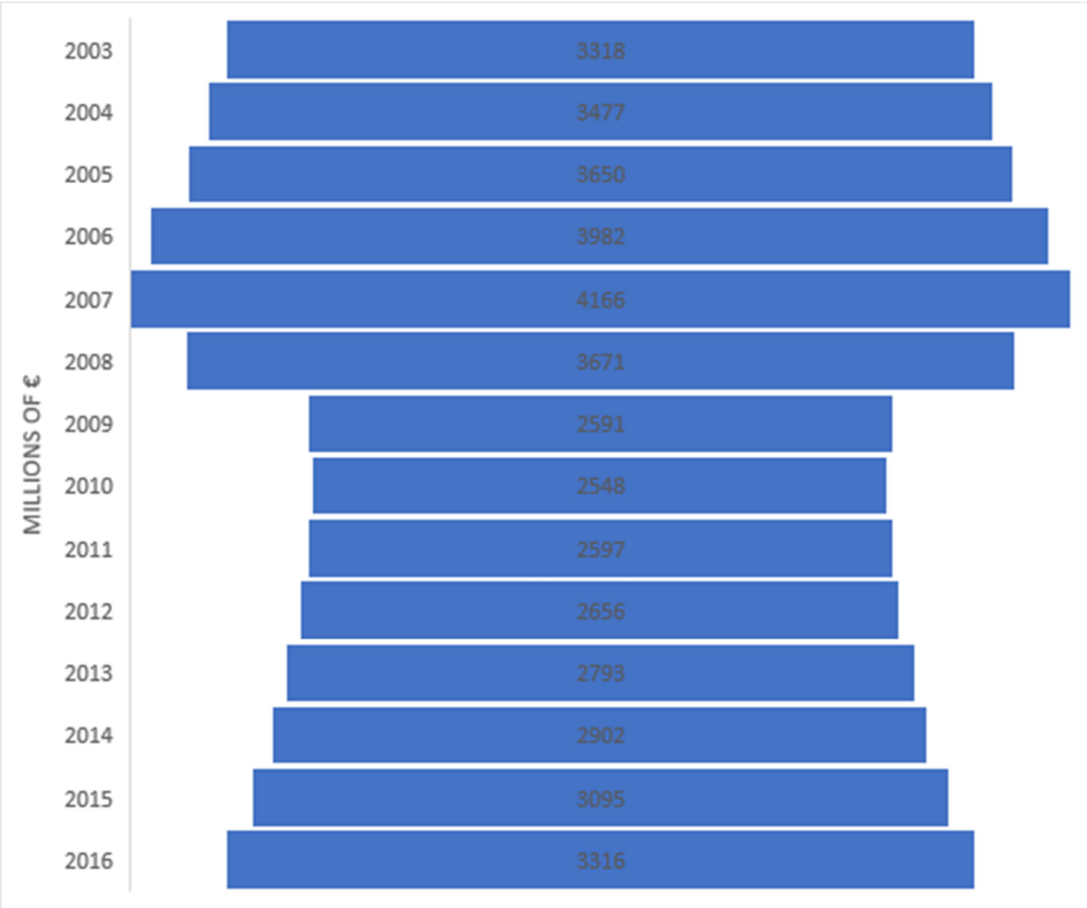


Source: Google Maps

2.1.2. Economical weight

As it is known, the ceramic industry is the business lung of the province of Castellón. 76% of the total Spanish exports of ceramic products originated mainly from the province of Castellón and this is where 80% of the companies of the sector are located. This subsection is prepared to answer the questions of how big is the ceramic sector of Castellón in numbers, be it billing, employment or presence of foreign capital

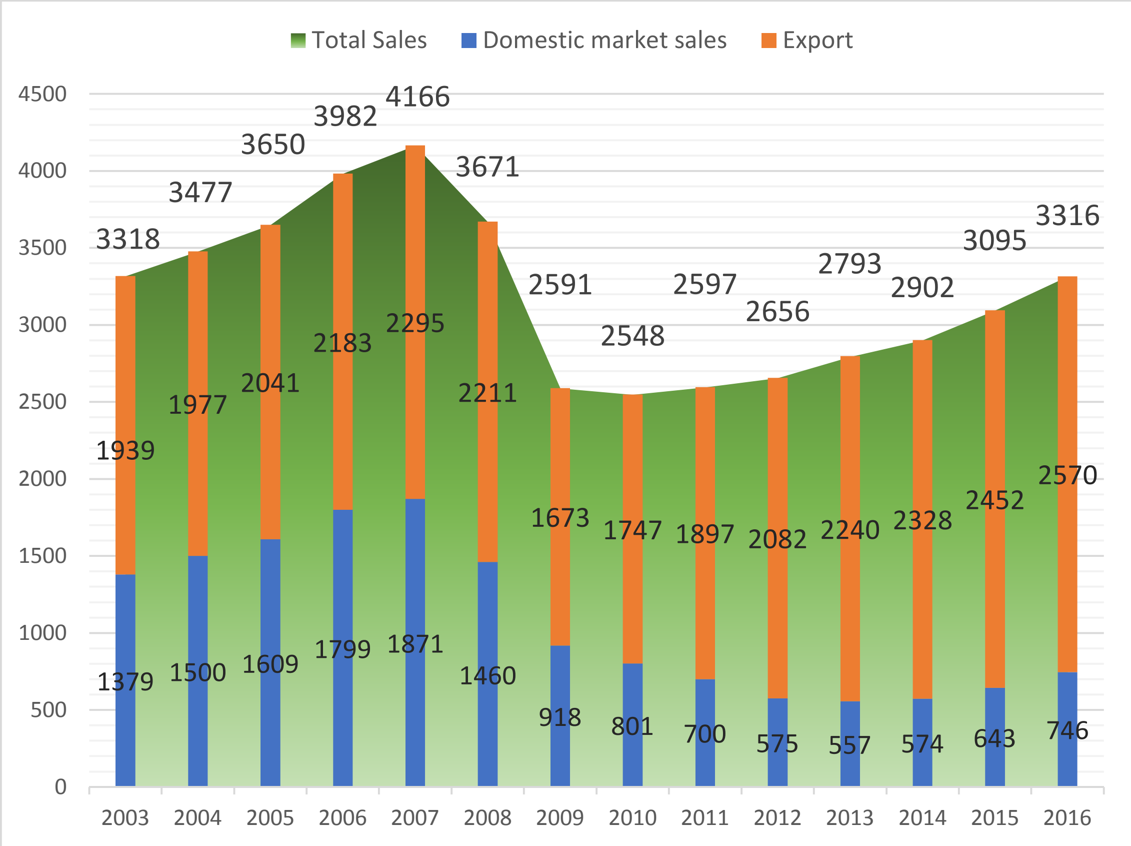
Graphic 1. Total Sales Evolution



Source: ASCER, 2017

As for the evolution of sales, we can say that from the outbreak of the crisis to the year 2010 there has been a downward trend in total sales, a slight decrease in international sales. On the other hand, domestic sales have meant a large decrease in sales, until approximately 2013-2014. This has been caused by a large decline in domestic consumption that the Spanish economy has had to resist for so many years. It is the exports that not only have kept up the industry, but have meant an increase more and more accentuated since the year 2010, passing in just 7 years of invoicing approximately of 1,747 million euros to 2,570 million euros, being the equivalent of an increase of 46%. According to ASCER, the forecast for the closing of results for the 2016 financial year is a slight growth, both in exports and sales in the domestic market. Total sales are expected to grow by 7% to reach 3,316 million Euros. In subchapter 2.3.3 a more detailed study will be done on the presence and evolution of Castellón's cluster in the international market and that of its main competitors.

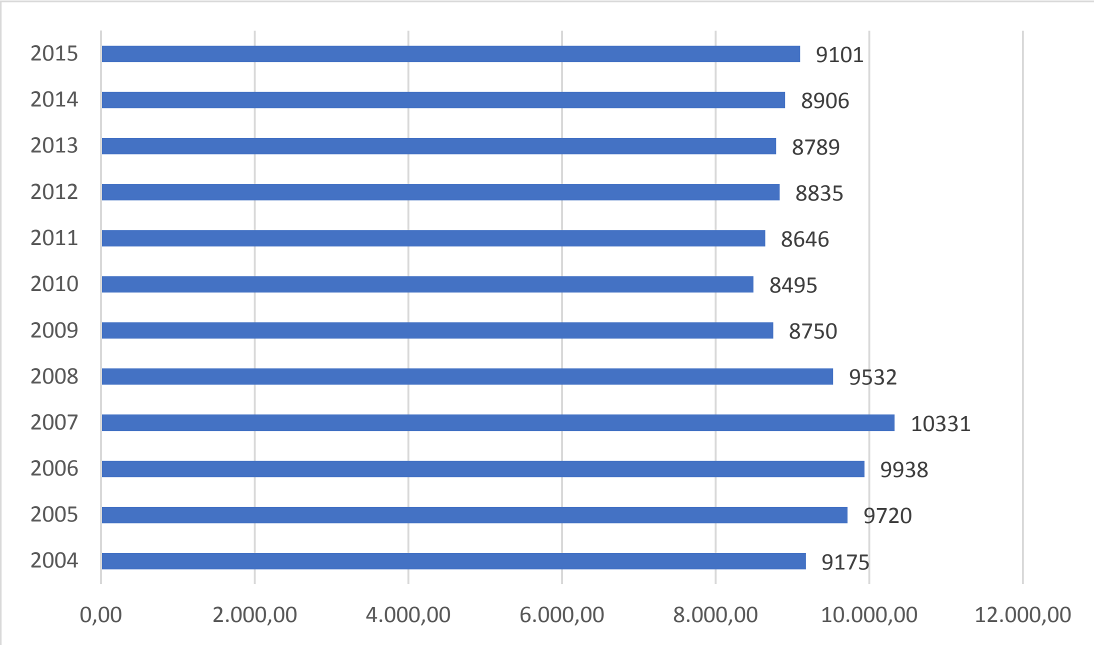
Graphic 2. Sales composition evolution



Source: ASCER, 2017

Based on the analysis of the billing, we emphasize that this is a very internationalized industry given the fact that export sales represent approximately 80% of the total, leaving a margin of approximately 20% for sales in the domestic market. Experience and knowledge depart as the differential values that have favored the presence of these products in 186 countries. The debacle suffering from the crisis and in the previous years (2008-2009) led to a 30% drop in exports; these are recovering continuously until reaching the pre-crisis value in 2014. Nevertheless, as of 2015, it managed to become the third industry with the largest surplus contributing to Spain's trade balance, with total sales amounting to approximately 3,075 million euros.

Graphic 3. Total Employees Evolution

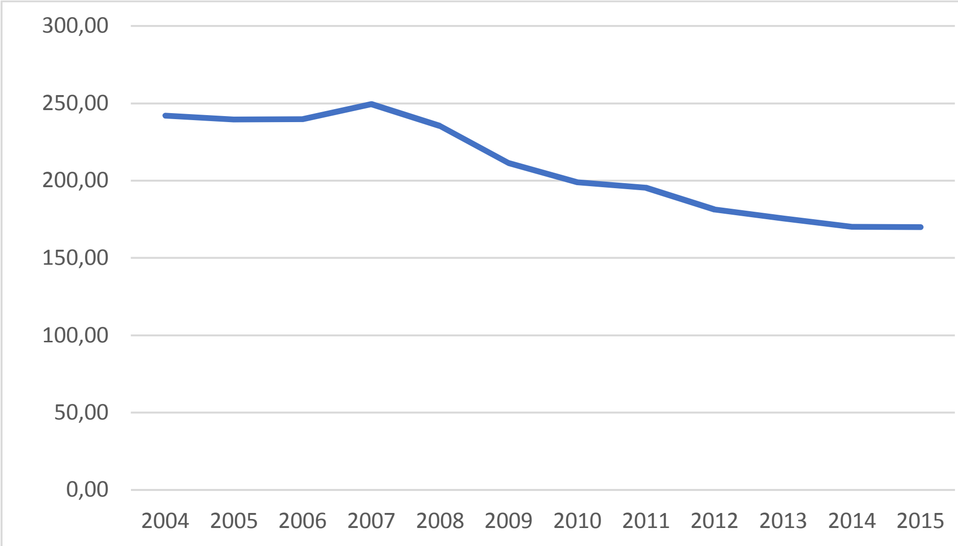


Source: SABI database, 2017

Another aspect of great interest in the analysis of the sector is the social impact on employment. We recall that, according to data published periodically by INE (National Institute of Statistics), the Spanish people identify unemployment as Spain's main concern since the burst of the real estate bubble of 2007 and the consequent financial crisis. Between April 2007 and April 2009, unemployment registered in the ceramic district increased progressively, with rates that at the peak reached a 140% increase over the same month of the previous year. Overall, the number of unemployed increased in this period by almost 250%. The ASCER data as of 2015 indicate that the ceramic industry generated direct employment of approximately 15,500, in addition to another 7,000 indirect jobs, mostly maintenance, logistics and public services. Regarding next year's figures, 2016, statistics indicate that direct employment has increased by approximately 500 direct jobs.

Another very relevant fact that I would like to highlight is the evolution of the standard deviation of the data corresponding to the distribution of the number of employees in the ceramic industry in the different companies.

Graphic 4. Typical deviation of employees data evolution



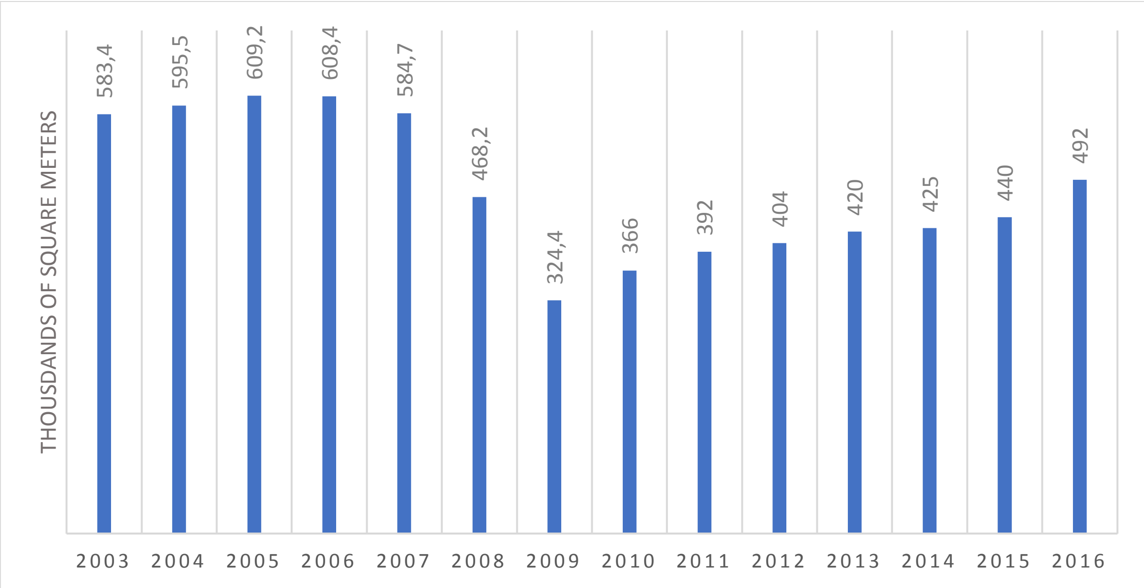
Source: SABI database, 2017

Thus, the reduction of the standard deviation symbolizes that, over time, the number of employees has followed an egalitarian tendency, that is to say, the difference between the high number of employees hired by large companies and those hired by small and medium-sized enterprises has decreased, generating a more equitable distribution of the number of employees among the different companies. Another reading that we could make of this graph is that the big companies have reduced to a greater extent the size of their personnel than the small and medium companies of the cluster

Another notable aspect is the inflow of foreign capital into the industry, especially after the outbreak of the crisis. The strong inflow of foreign capital into the ceramic production subsector, facilitated by the crisis of some of the large cluster companies such as KERABEN, acquired in 2015 by the US, founded Tensile Capital Management, Cretaprint in 2012 by EFI (Electronics for Imaging) or the group of Arab investors Investcorp, with the purchase of Esmalgrass in 2012 among others. Thus, at present, around 19% of the employment and 29% of the production of the cluster corresponds to companies affiliated with foreign groups. Consideration should also be given to international business groups, but with a local matrix, which are also a very important part of the cluster, accounting for 31% of employment and 32% of production. Altogether, 50% of the jobs and 61% of the production of the cluster are integrated in corporate structures of international dimension.

As for the production, here we can find a graphic which shows us the historical evolution.

Graphic 5. Production performance evolution



Source: ASCER, 2017

As we can see, the level of production has been seriously affected by the outbreak of the economic crisis of 2007, falling from 584.7 million square meters to 324.4 in 2009, which represents a decrease of approximately 45%. Since that year, production has been increasing, mainly driven, as we shall see, by the boom in exports. Thus, for the last fiscal year, 2016, production has already reached the figure of 492 million square meters, being the best result since 2007, and the trend is expected to continue rising.

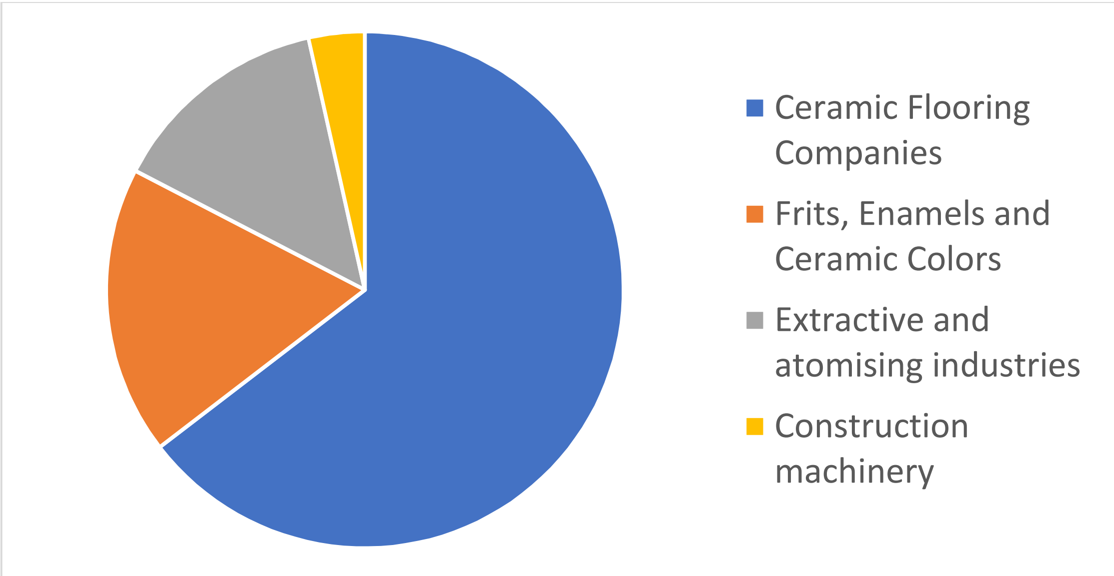
2.1.3 Composition and financial characteristics

In this subsection we will make a brief but concise analysis on the evolution of the main economic indicators. For this analysis data from the 21 largest companies in the sector1 have been used, taking into account their billing in the last available fiscal year (2015). The companies analyzed were:

The data studied contained in some cases a very high standard deviation, which means that the performance of the companies is very different and there may be data or companies that influence very drastically the average result of the analysis.

Firstly, we will represent in the following graph the economic weight (depending on the average of its assets in the last 10 years) of each of the sub-sectors discussed above:

Graphic 6. Ceramic cluster composition (total assets analysis)

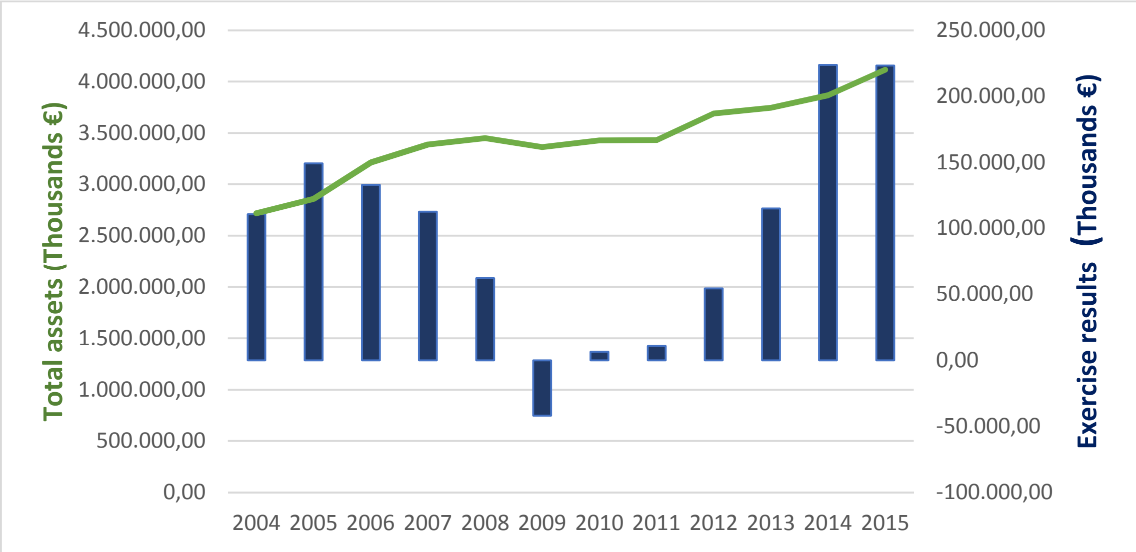


Source: SABI 2017

Therefore, we see how the great part of the economic activity is concentrated in the companies specialized in Ceramic Flooring, we find in this list two great companies of the industry like Pamesa and Porcelanosa.

Far behind are the companies of frits, enamels and colors, and the extractive and atomizing industries, which make up approximately 29% of the weight of the ceramic industry.

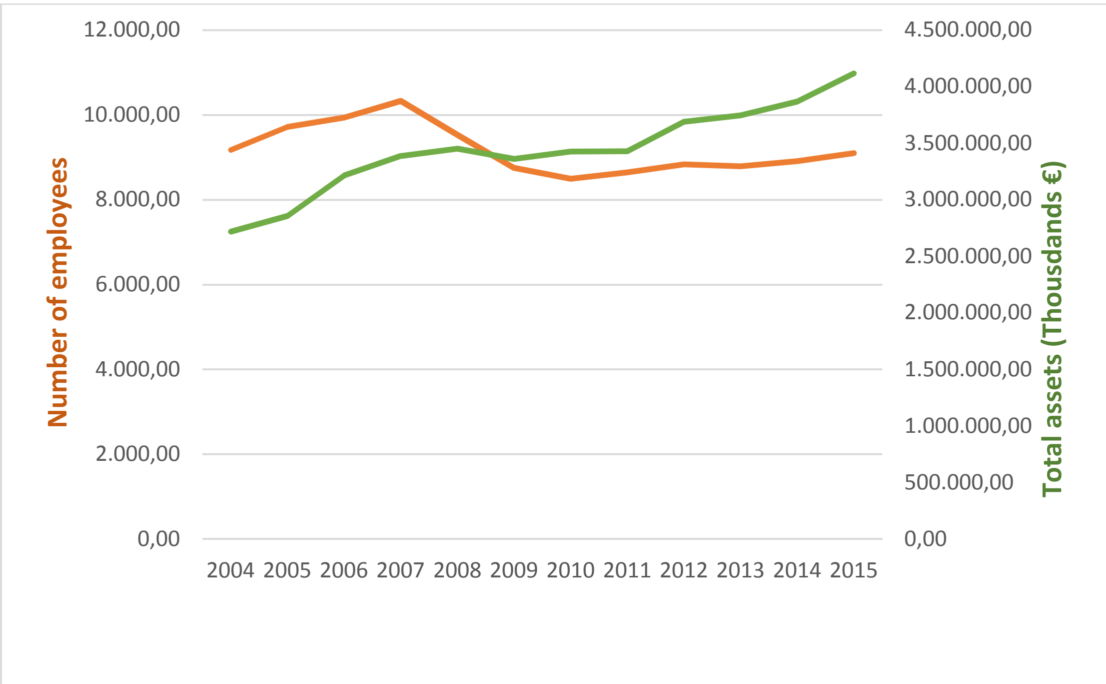
Graphic 7. Total assets and exercise results evolution



Source: SABI 2017

This table shows the evolution of the assets with respect to the companies' results. We can appreciate how the crisis of 2007 meant a big drop in the results, especially for 2009, which was also noticed in a slight decline in the number of assets. However, the last two years have turned out to be even more positive than the ones before the crisis.

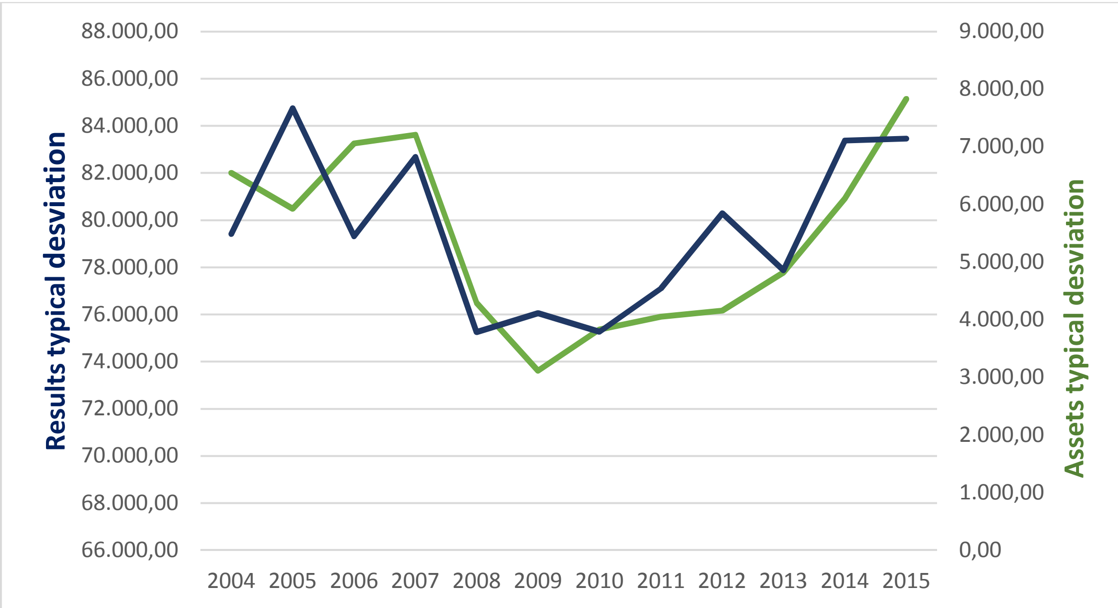
Graphic 8. Employees and total assets evolution



Source: SABI 2017

As in the previous graph, we can perceive how the crisis has also affected the number of employees hired by companies. Unlike the evolution of assets, the recovery of this indicator seems to resist more to returning to pre-crisis figures, while the assets and results of the company have already surpassed numbers prior to the crisis of 2007.

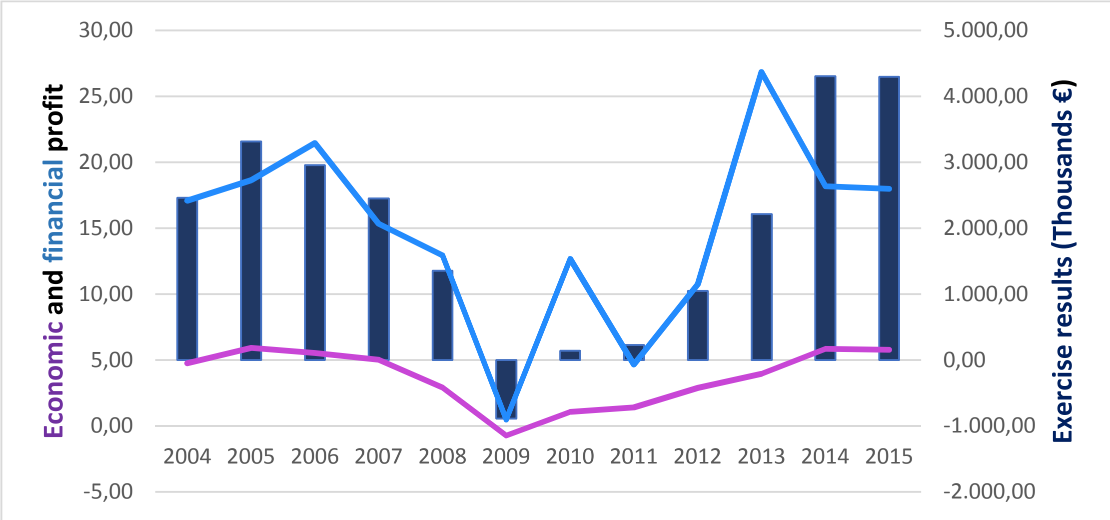
Graphic 9. Assets and results typical deviation



Source: SABI 2017

An interesting observation that we can conclude from this graph is that, in the years of economic decline, the typical deviation of the results and of the assets is smaller than in the years of economic growth. What this shows us is that, when companies have losses, these tend to be similar between different companies, whereas when there is economic growth, the result and the increase in economic assets is much higher in large companies than in small ones.

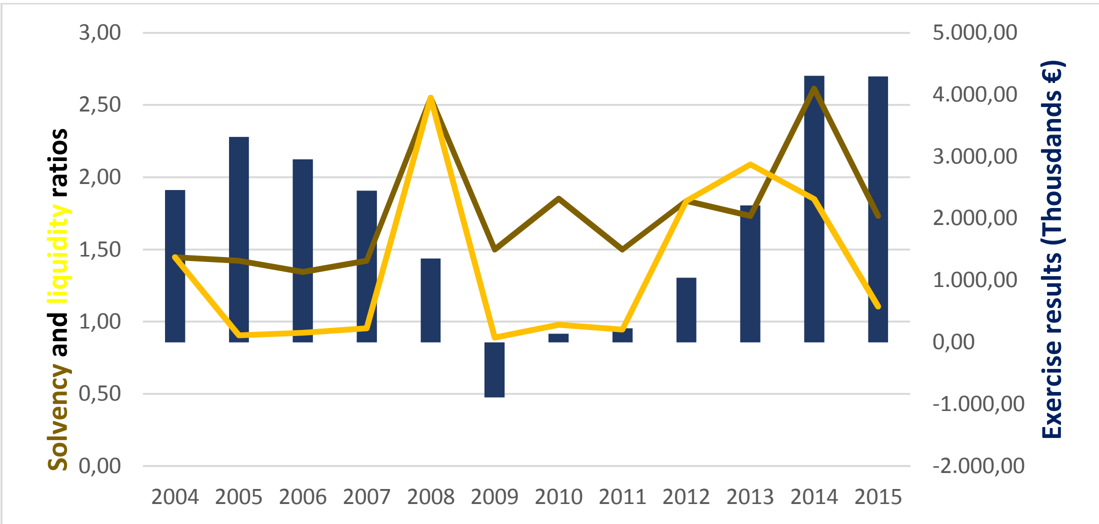
Graphic 10. Profit and results evolution



Source: SABI 2017

One conclusion that we can draw from this graph is that, in 2013, it was perhaps the year that the cluster officially emerged from the economic crisis, reaching an average of 27% financial profit.

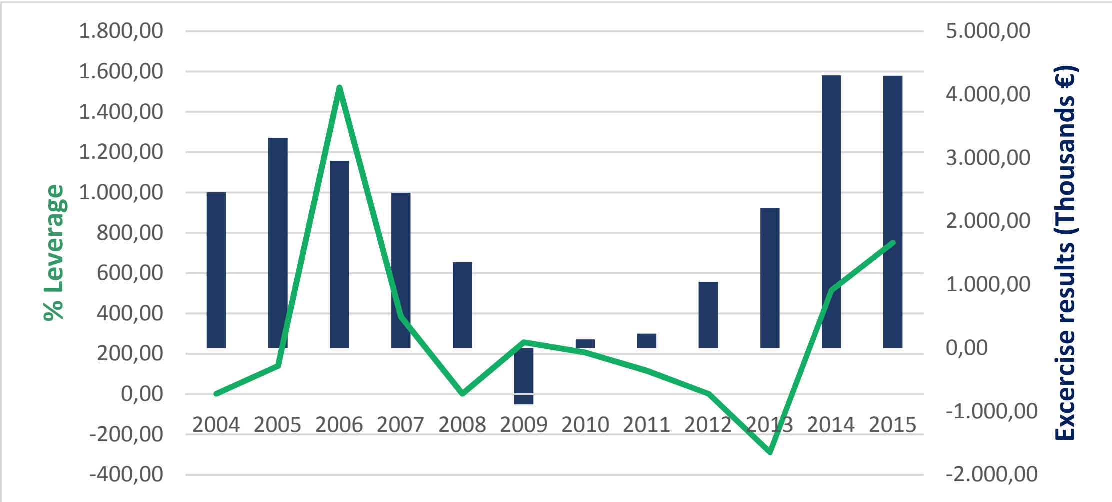
Graphic 11. Solvency and liquidity evolution



Source: SABI 2017

This graph shows that the solvency and liquidity ratios have evolved quite irregularly over the years. Although it is an indicator that can give us little information, we can see how the year 2014 was a year in which the solvency ratios became almost equal to the year after the crisis, which in the first instance could seem a worrying fact.

Graphic 12. Leverage evolution



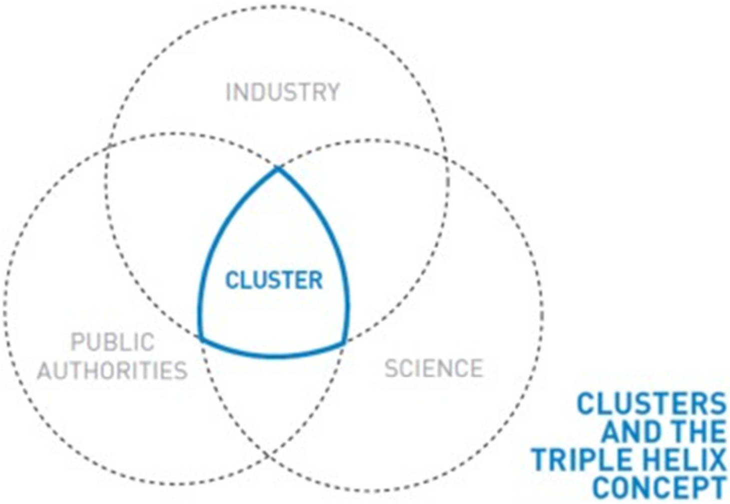
Source: SABI 2017

The evolution of leverage gives us an idea about the level of indebtedness of companies with respect to their assets. Thus, while the pre-crisis level was very satisfactory, the years of economic decline have increased corporate debt in such a way that it was not possible until 2014 to cover the amount of debts with the total assets of the companies.

2.1. Public Actors

It is important to understand that an industrial cluster is not only composed of companies specialized in a specific activity, but the existence of other actors that complement and benefit their activity is necessary. These are industries whose social leadership is so great for their geographic community that a poor performance of these can be very negative for the welfare of the citizen (see the case of the Detroit automobile cluster). This implies that public authorities should pay particular attention to the latter's needs and try to create the best possible framework for these companies to thrive in the market. From these observations, we find the concept of "triple helix" whose assertion is that an industrial cluster is not merely a composition of companies belonging to the same sector, but also must exist a very close collaboration of these with organizations that complement its activity as is the case of public institutions and training centers.

Illustration 4. The triple hélix concept



Source: www.infotech.org.pl

In the present case, among the agents present in this local institutional network, we can classify them according to: business associations, professional associations, trade union centers, training centers, technological centers and cultural spaces.

In the following map we find the location of some of the main public spaces discussed previously:

Illustration 5. Main public actors localization

Source: ASCER & Google Maps

A) Business associations and sector support: these are organizations whose role is to obtain and generate information to make it available to stakeholders in relation to the sector as a whole and to the main stakeholders to deliberate on everything related to the economic activity of the tile cluster. The most outstanding case is the Spanish Association of Manufacturers of Ceramic Tiles and Pavements (ASCER). On the other hand, we also find organizations that revolve around activities or more specific sectors such as the National Association of Manufacturers of Frits and Colors and Ceramic Colors (ANFFECC) or the Spanish Association of Manufacturers of Equipment for Ceramics.

Professional associations: This is the case of those organizations that play a very important role in the dissemination of novelties in terms of information and technological knowledge. It is possible to emphasize like a maximum responsible the Association of Ceramic Technicians (ATC).

Trade union centers: As the constitutional law indicates, workers have the possibility of joining unions that defend their interests against employers, and in the case of the tile sector there is no exception. Of particular note are the regional delegations of the UGT (General Workers' Union) and CCOO (Confederación Sindical de Comisiones Obreras or Trade Union Confederation of Workers' Commissions).

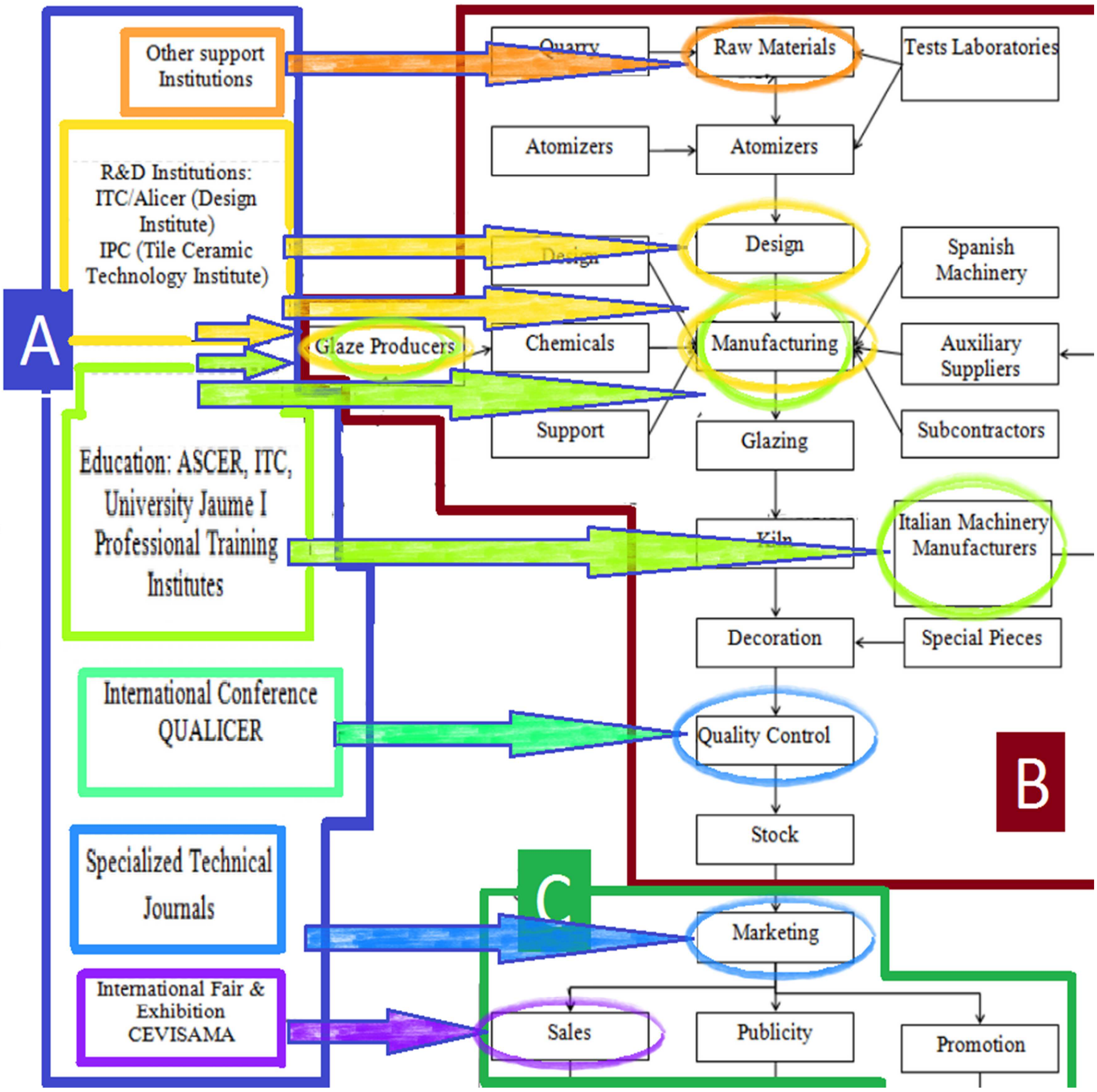
Training Centers: The most relevant case is the Jaume I University (UJI), in Castellón, in particular the departments of the chemical branch, although not less important are the different Provincial Vocational Training Centers, both general and others whose mission is to serve the ceramic sector as it is the case of the School of Arts and Crafts, or the Higher School of Ceramics of l'Alcora, that offers the qualification of ceramic superior technician.

Technological Centers: Less known are the cases of technological centers of ceramics, whose mission is to serve the cluster through research and development studies. The most outstanding case is the ITC (Institute of Ceramic Technology), which is part of the educational complex of the Jaume I University.

Cultural spaces: This is the case of exhibitions, museums or even public spaces such as parks, which commemorate and expose the history of the Castellon community in the world of ceramics. The most symbolic cases are the Museu Cerámic L'Alcora, the Tile Museum Manolo Safont or the Museum of Belles Arts in Castellón

In the following illustration, by way of synthesis, we can see which area of the value chain influences the different institutions:

Illustration 6. Public actors roles on the value chain



*Adaptation of Positioning in the Global Value Chain as a Sustainable Strategy: A Case Study in a Mature Industry Jose Albors-Garrigos *, Blanca de Miguel Molina and Maria de Miguel Molina*

2.3. Marketing

One of the generally accepted definitions of the concept of marketing is: "a business process by which goods and services move from concept to customer" or in other words, a way of thinking about the business in terms of customer needs and satisfaction. It is, therefore, fundamental to understand the customer, his needs, desires, fears, etc. In terms of the areas of marketing, a very generalized approach is the marketing mix, or the 4 P's of Porter (Product, Price, Place and Promotion). In the present case, we will focus on the study of two key aspects; the product and the promotion. The product will answer the question of what is what one wants to sell, and the promotion will give us an idea about how the product is communicated to the customer; as he is made to understand that the product adds value.

2.3.1 Product

From my point of view, the quest for the final product's perfection must be a search for the perfect combination of three variables; efficiency or economic cost, effectiveness or utility, and beauty. The first two variables are taken care of by the technical and administrative departments of the company and the other variable is responsibility of the "artistic" departments, these being those of intelligence, commercial research, design or promotion among others.

First, we will make a classification of the main typologies that are being produced by the main companies of the sector of Castellón to later illustrate the main stylistic tendencies of the moment.

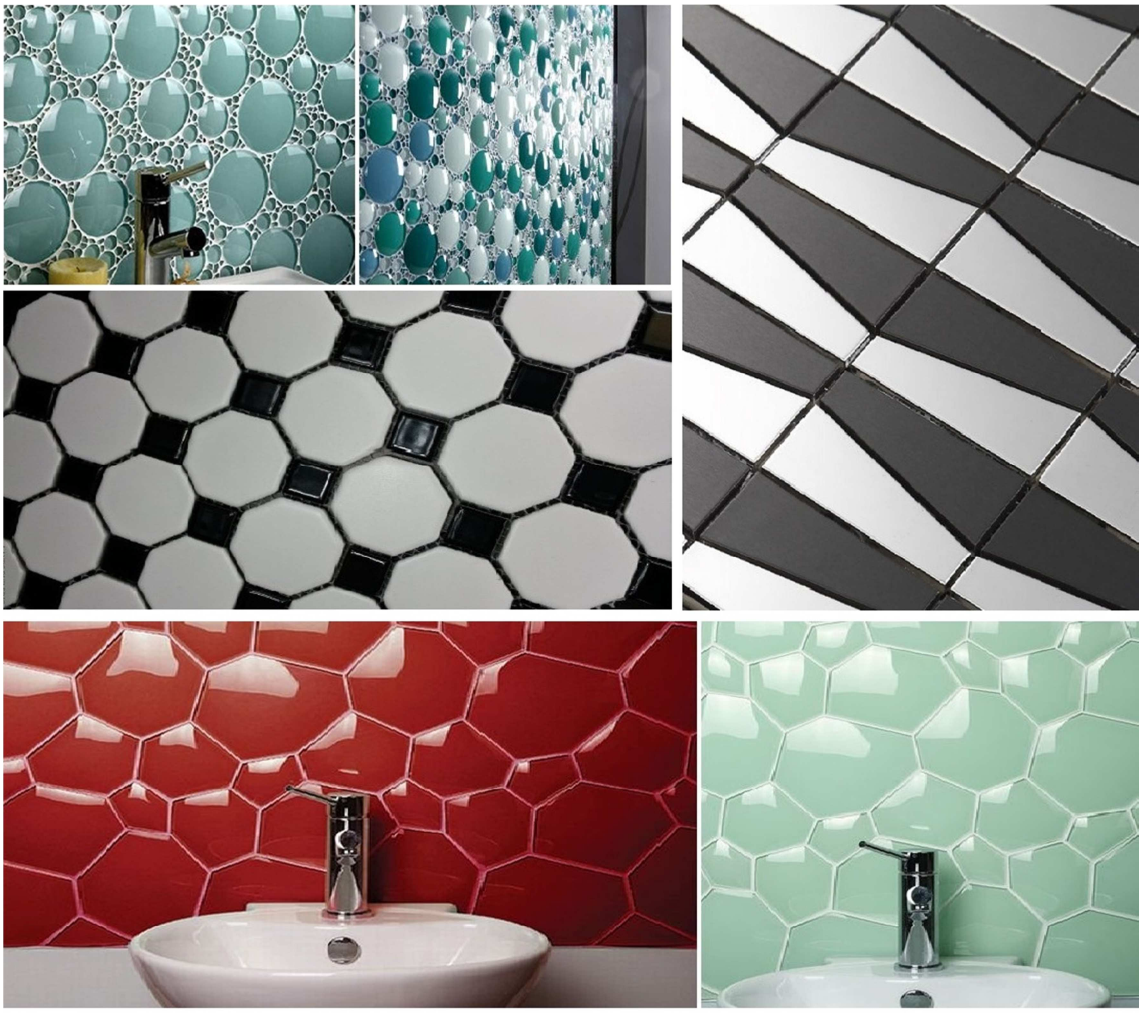
Typologies

If we stop to think, there are almost infinite possibilities when designing a product. In my view, there are two key aspects that we can manipulate; shape and material. As for the shape we can play with: geometry, mosaics and level of rectification and as to the material we have: the composition of the paste used and the degree of absorption of water (stoneware).

Special Geometry

The first characteristic is related to the geometric form that the tile adopts. As we can deduce, the most common form in which the final product is presented is the regular polygon, but besides it there are many other trends currently on the market, highlighting regular hexagons and octagons, irregular polygons or curvilinear shapes among others.

Illustration 7. Examples of special geometry ceramic tiles



Own elaboration

Mosaic

However, another way to create new forms is to combine different pieces in order to elaborate mosaics. We recognize a ceramic mosaic as a pictorial work made from small ceramic pieces of different colors or forms to form geometric or figurative decorative compositions. In the present case, we find the option of creating a mosaic from enameled or non-enameled ceramic pieces. Visual differences can be seen in the brightness of these ceramic pieces:

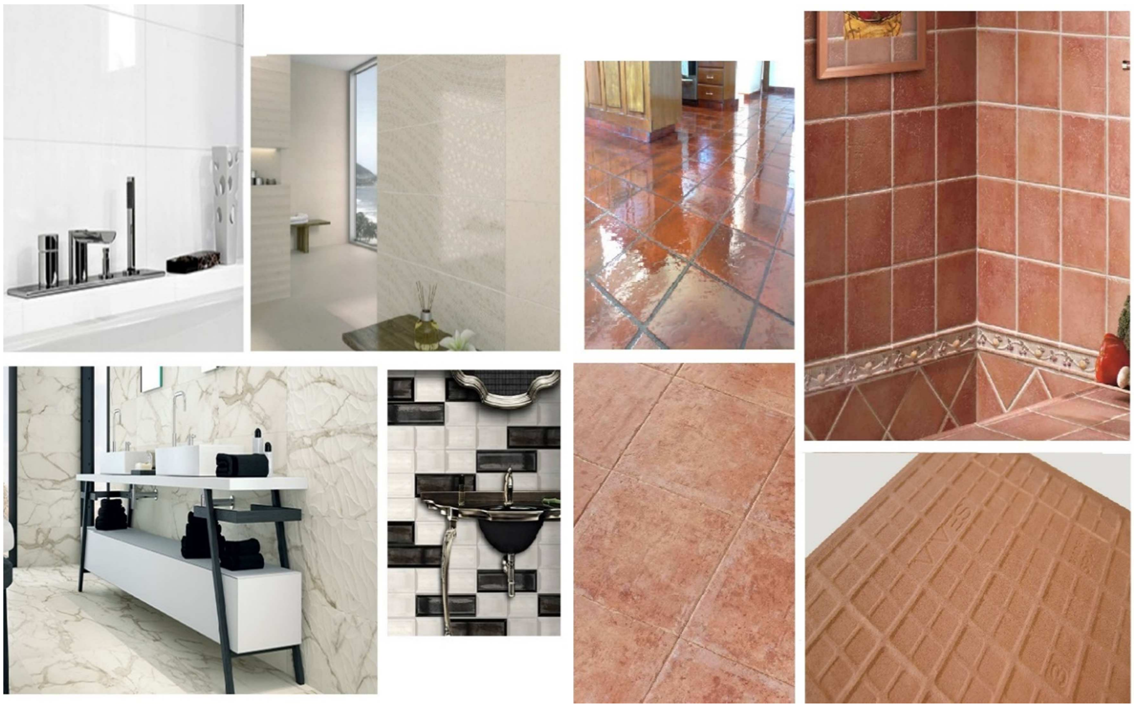
Illustration 8. Examples of mosaic ceramic tiles

Own elaboration

<u>Type of paste; red or white</u>

Another variation is the choice of the type of pasta used. It is a measure, ranging from the white pasta, which are considered the most pure and therefore the best valued in the market and red pasta that is just the opposite. The ones to choose a type of pasta or another would be of the following form:

Illustration 9. Examples of red and white pasta ceramic tiles



Own elaboration

We have to emphasize that the obtaining of raw material for the preparation of white paste does not predominate in the area of Castellón, being necessary its importation from countries like Ukraine or Algeria.

Stoneware

Finally, we find the Stoneware. It should be noted that the only difference between porcelain stoneware and regular ceramics is that the clay used in porcelain stoneware is much more refined and purified.

Depending on the degree of water absorption, it is usually classified into 3 large groups; enameled, porcelain and rustic stoneware.

Illustration 10. Enameled, porcelain and rustic stoneware

Own elaboration

Rectified and unrectified tiles.

The basic difference between the rectified and the unrectified tiles lies in the gap between pieces. Whereas the regular ceramic tile is usually placed from 4 or 5 mm to 10 mm away, depending on the size of the tile, the rectified ones are usually placed less than 2 mm apart. This happens because the ground ceramic has a cut edge to facilitate its union whereas the normal one, having a rounded edge requires a greater separation to allow a correct union. A key factor in deciding the type of tile is its location, for example, it is much more common to find rectified tiles in offices, not rectified in swimming pools and something intermediate in house floors, as can be seen in the following images:

Illustration 11. Examples of different degrees of ceramic rectification

Own elaboration

<u>*Enameled and non-enameled tile*</u>

It should be noted that the percentage of exported enameled tiles is almost 90%, while non-enameled tiles account for only 6% of exports as for 2015, with statues and decorative objects, tiles or sinks distributed among others.

Style trends

We understand style as a procedure by which something is done; a manner or way, a distinctive appearance, typically determined by the principles according to which something is designed.

In this sub-section, some of the main trends in the market for ceramic products and their main characteristics will be briefly illustrated.

For this study, the trend dossier on ceramic claddings and pavements published by ASCER in February 2017 was used as the main reference and the catalog of the Cevisama exhibition at the end of February 2017, held in Valencia, as well as others Blogs like (Cifre Inspire). The following styles stand out: Exoticism, Fragments, Brick, Chevron pattern, In the right direction, Objects of art, Soft touch, Gray scale, Oversize and Aquatic life and Cottage.

Exoticism

This style is also called tropical. It usually contains elements like Hawaiian flowers, jungle plants or exotic birds, although always from a simplistic approach.

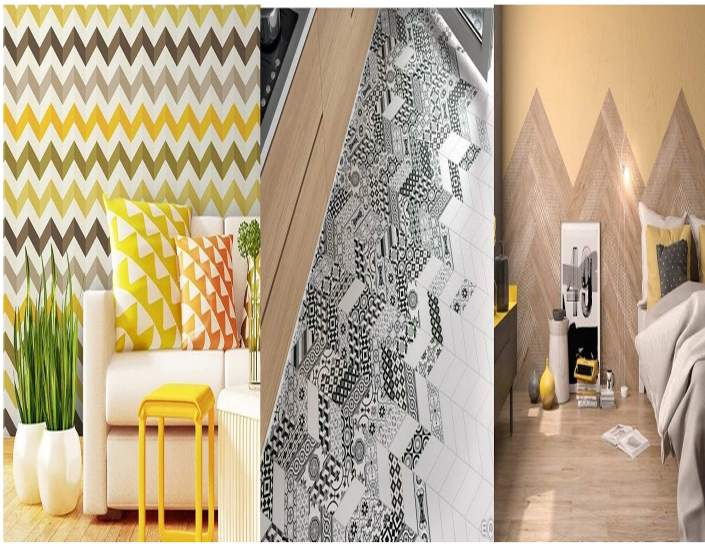
This style plays with the idea of modularity, designing patterns that are fragmented through compositions of square and rectangular tiles.

Fragments

Brick

Obviously, this style adopts the brick form as a key element of the setting.

This style uses ceramic tiles and pavements that form a zigzag pattern.

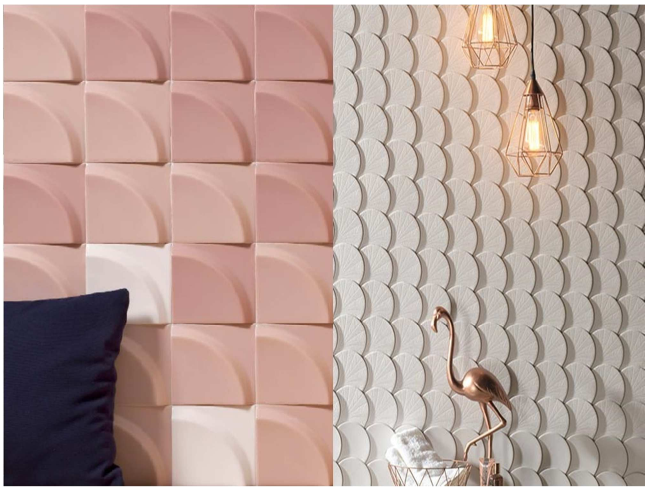


Chevron pattern

The right direction

In 2016, the most basic element of design, the lines, were used in almost infinite combinations; vertical or horizontal, continuous or discontinuous, flat or embossed, etc.

The versatile blend of textile effects produces all kinds of environments that make decoration warmer.



Soft touch

Grey scale

Despite the recent increase in color combinations in the latest decor trends, gray has always been the best choice for contemporary designers.

Of little thickness and maximum size, XXL pieces can be used to cover large surfaces and to make the joints disappear, taking advantage of this to exploit the feeling of continuity

Oversize

Aquatic life

The range of cool colors reminiscent of aquatic life begins to be present in ceramic tile collections.

It is recognized for its rustic air mixed with romantic and subtle elements. The decoration seeks to mimic nature.

Cottage

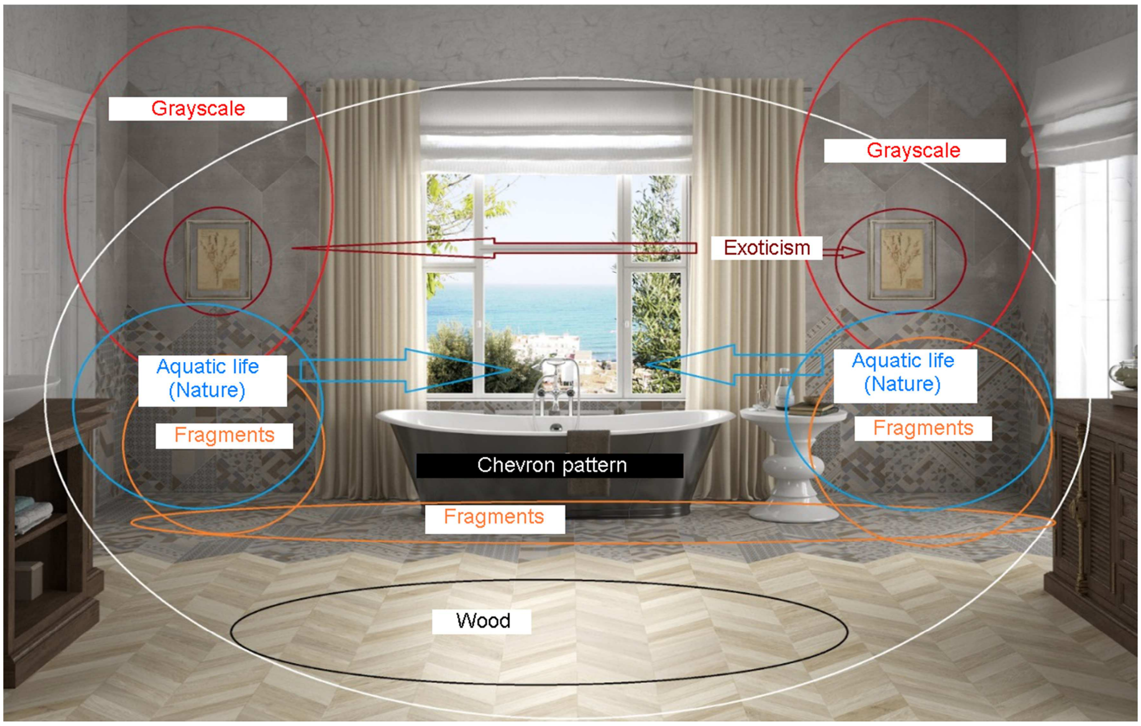
Art objects

Lastly, we are dealing with a trend that explores the multiple ways of transforming the ceramic tile into a cult object. These are unique pieces that can make any stay unique. The result is sophisticated spaces, but without decorative excesses, that do not neglect the details and that find in the contemporary ceramic pieces the perfect complement.

Art objects

It needs to be highlighted that it is also very common to find designs that combine more of a concrete style as it can be seen in the following illustration where a combination of several styles set out above is created:

Illustration 12. Examples of various styles combined



Own elaboration

2.3.2. Promotion

As we have previously concluded, promotion is the process in charge of communicating the value of the product to the consumer. The peculiarity of the promotional method is that it only implies an improvement in the added value of the product to the extent that the final customer perceives and accepts it as such, that is, it must be a product that, in Plato's words, approaches as much as possible to the idea of beauty, and in the business world, the process that deals with playing with consumer psychology is the promotion.

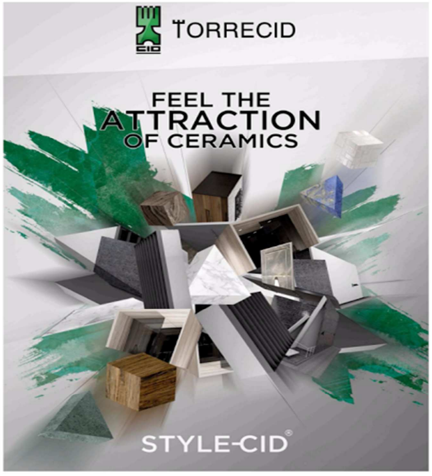
Visual promotion

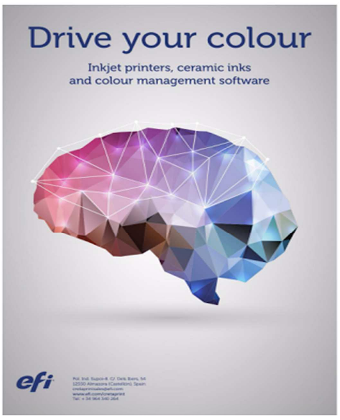
First, we will start by studying the promotional strategies adopted by the main world ceramic industries. This will be carried out through the analysis of several promotional images published in specialized magazines in the ceramic sector. Being these ceramic industries the Spanish, the Italian and the Chinese.

Spanish Promotion

We will start by studying the case of the ceramic industry of Castellón with the study of the following advertising cases found in the popular Italian magazine:

Illustration 13. Spanish examples of visual advertisements





Own elaboration

We can appreciate how in the case of the Spanish ceramic sector there is a very great concern for the image rather than for the text, unlike in the Italian case and especially in the Chinese. Direct references to elements related to ceramics are made through shapes and colors. Neutral backgrounds, contrast of colors and sizes, and harmonic composition prevail. Another notable aspect is the simplicity in some of its ads, looking for a minimalist style as well as the originality of some of these. The implicit message to be transmitted to the consumer is that of innovation and simplicity. It is possible to be deduced that the advertising is focused on a modern ceramic sector where technology has great importance.

Italian Promotion

Illustration 14. Italian examples of visual advertisements

Own elaboration

The Italian ceramic sector, very similar to the Spanish one, tries to play with the image and creativity in its ads. The Italian advertising is quite regular, little interest in the aesthetic image of ads and a great deal of interest in symbolism. Being one of the main, but the greatest, competitive advantages of these companies, the history and prestige of the Italian brand, we can see how almost in all the ads appears the Italian flag as a seal of quality and reputation. Still, the graphic results do not clearly communicate what type of product is and for what type of audience it is targeted. New aesthetic trends are combined in an incorrect way and this affects graphic communication.

Chinese Promotion

Illustration 15. Chinese example of visual advertisements

Own elaboration

In the Chinese case, we can see that advertising works in a different way. We can see images that are much more concerned with information than with print, a quality that gives a very direct character as to the purpose of the message. The best feature of these is the quantity and the size. We see how in an illustration they emphasize the fact that it is the organization of one of the biggest fairs in the world. The visual language that works correctly is the textual one. Lots of text and little graphic image. The biggest and the most accessible, "the most" that is the message that one wants to convey from Chinese companies.

To sum up, we can conclude that the strategy adapted by Spanish companies lies in the innovation and creativity, trying to impress the reader through the presentation of a very modern visual content. As for the Italians, they decide to exploit their distinctiveness which is the Italian brand, a carrier of reputation and prestige worldwide because they are thought to be the trendsetters. Finally, the Chinese bet on being "the most"; the larger, lower costs, with greater variety of products or greater productive capacity.

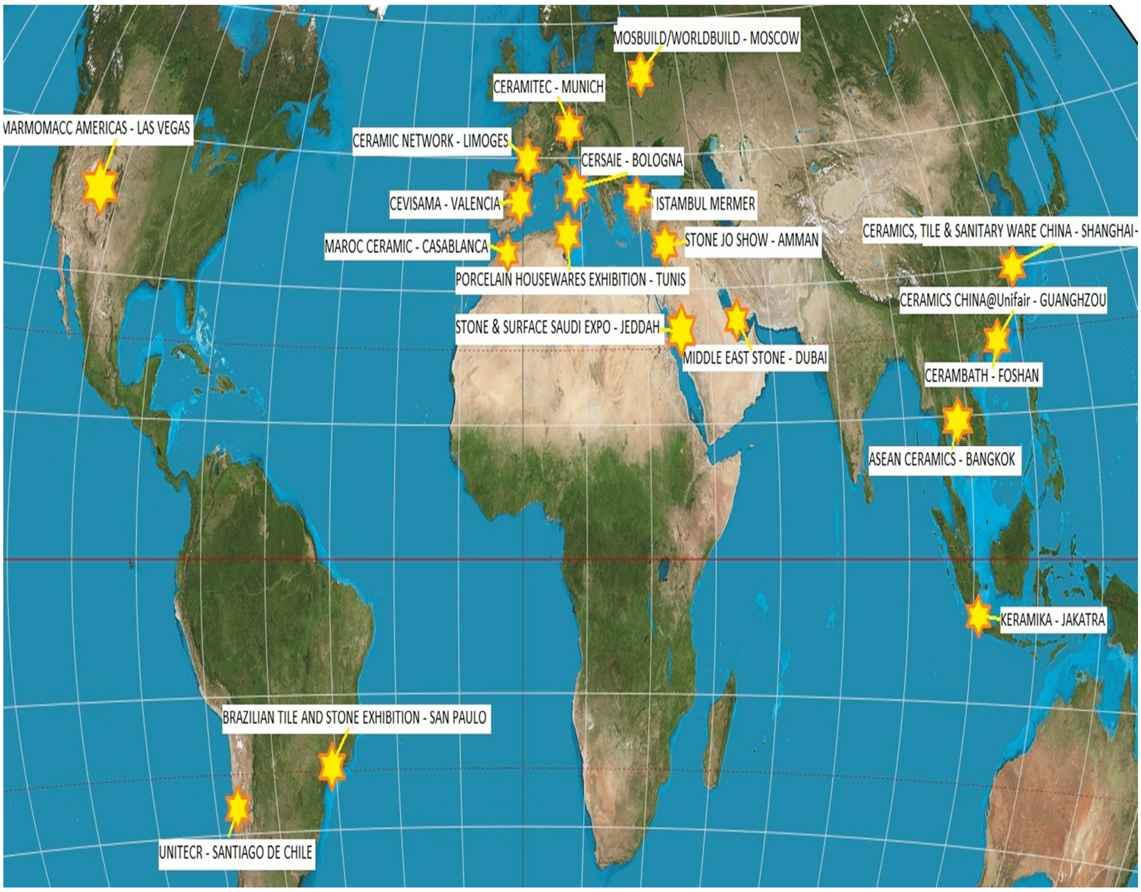
Trade exhibitions

The most traditional method and which today remains the best valued are the agents' physical meetings. This is done thanks to the organization of trade exhibitions and fairs in order to bring together people of interest from a particular field.

This tool is a meeting point between supply and demand, thus facilitating business. Thus, it is the ideal medium to introduce products or services, observe the competition, test or launch products, study the market, visit and be visited by its customers, find distributors and make sales or even be recognized with prizes awarded by the organizer.

In the following illustration we can find some of the main international fairs with respect to the ceramics that are being organized nowadays in the world:

Illustration 16. World mains ceramic trade exhibitions



Own elaboration

CEVISAMA is the trade fair which concerns Castellón's cluster the most, due to its proximity and international relevance and it should be noted that the data of the last year registered (2016) indicated a presence of 78,221 professionals, 14,923 of which were foreign buyers coming from 145 different countries, being this best result in Cevisama's 34-year history. Thus we conclude that this is an increasing promotional phenomenon and with a high commercial potential.

Online promotion

Finally, it has been considered interesting to study online promotion. For that we have used tools like Google Search and Google Trends to collect data of interest about the activity of key search terms.

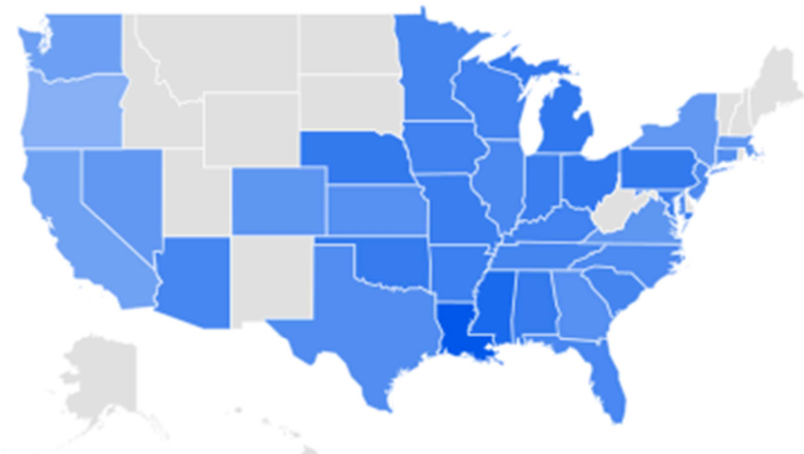
In what concerns us we will make a brief analysis on the searches in the US network, for its economic potential and reference in the online world, the Spanish network and the world in general.

For the American market we see the ceramic tile floor as the main queries related to ceramics. I would also like to highlight as a surprising fact in relation to the taste of the market, the great relevance of wood ceramic tile in the search engine ahead of even porcelain tile.

If we make the search from the USA Google configuration, we find that in the case of the search "ceramic tile floor" we do not find any trace of Spanish companies but we found through some dominion of Italian companies like Marazzi or Iris. In the case of porcelain, we find PORCELANOSA just on the 4 page search, behind Italians like Corso Italia or Eleganzatiles. Thus we can conclude that the Italian cluster is better positioned in the USA Google search engines.

Regarding the location of the consultations, these are the main areas:

Illustration 17. USA states with most searches for "ceramic" on Google



Own elaboration

We see how the southern states stand out, with Louisiana at the top, as well as those states in the eastern.

In the Spanish search network, we have found some surprising data. The fifth most used word related with ceramics is that of a trademark; Leroy Merlin ceramics and the first word related with a brand of the sector we found it in the 14th position as; Tau ceramics.

Regarding Google's organic search results, we find the following order: ASCER, Saloni, Yellow pages, Leroy Merlin (special pieces and exterior and terrace), Mutina.it, Equipe (Spanish), Ceramicamayor, Argenta, Institute of Ceramic Technology, Errece, Ceramic Magazine, Pamesa, Vives ceramics, Ceramica Bardelli, KEROS CERAMICA, Ceramica Italia, etc.

Thus we see how we find a mixture of pages of ceramic institutions, companies both manufacturers and commercial as well as Spanish and Italian, or magazines.

It is surprising that there are so many well positioned Italian companies so in the national search results, which indicates that they have a strong impact on our own industrial area.

However, in the Italian search network, the term “ceramic” does not target any Spanish company in any of the first 13 search pages, even though in the previous case we have analyzed just 4 pages of search.

We can say that the position of Spanish companies in the network is much less developed than the Italian, both in the US market and in the country itself which is an aspect that should be taken into consideration by companies. Even so, it should be noted that the strategies adopted by companies in this respect are usually more branding than selling, so it tends to have a more medium-long-term focus since those who actually make the sales through the internet to the final customers are usually commercial companies as for example Leroy Merlin.

2.3.3 Markets

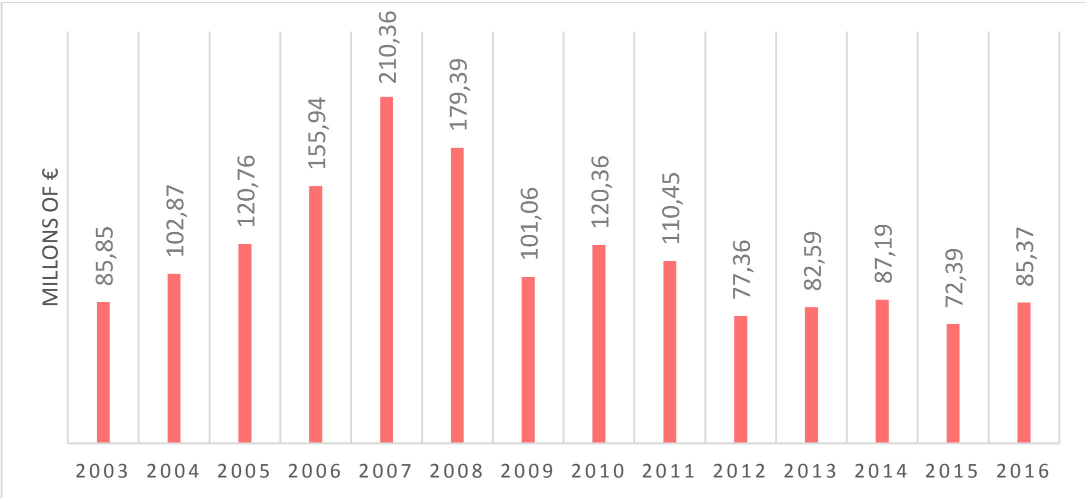
In this chapter we will focus on analyzing the commercial data concerning the Castellón cluster. Through the data collected we will try to give a diagnosis as accurate as possible of the historical evolution and future forecast of the sector in terms of national import and the national and international export and secondly decomposes these numbers to locate the main foreign markets and their evolution.

<u>Imports</u>

This subsection supposes a deviation from the objective of the chapter since, rather than to study the situation of the Castellón cluster, we will take care of the position that occupies the competition in the Spanish territory and from there the concision of the analysis.

First, we will take a look at the graph on the evolution of total imports in the following chart:

Graphic 13. Imports evolution

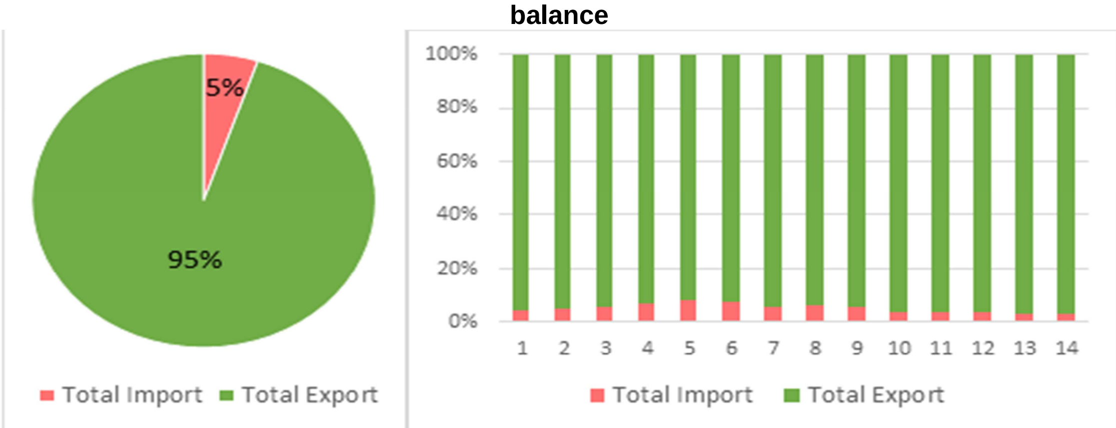


Source: DataComex, 2017

We see how, in times of prosperity, imports have followed an upward trend, reaching up to 210 million euros. In 2007, with the outbreak of the crisis and the consequent drop in domestic consumption, these have dropped drastically, in 2 years, in slightly more than half and then they followed a rather irregular evolution with ups and downs, year by year until 2016, the last fiscal year.

As expected, the weight of imports with respect to the consumption of Spanish product is much lower because Castellón is, as we have pointed out throughout this work, one of the largest world ceramic industries and this fact is illustrated in the following graphs:

Graphics 14 and 15. Balance of the historical commercial and evolution of the trade balance

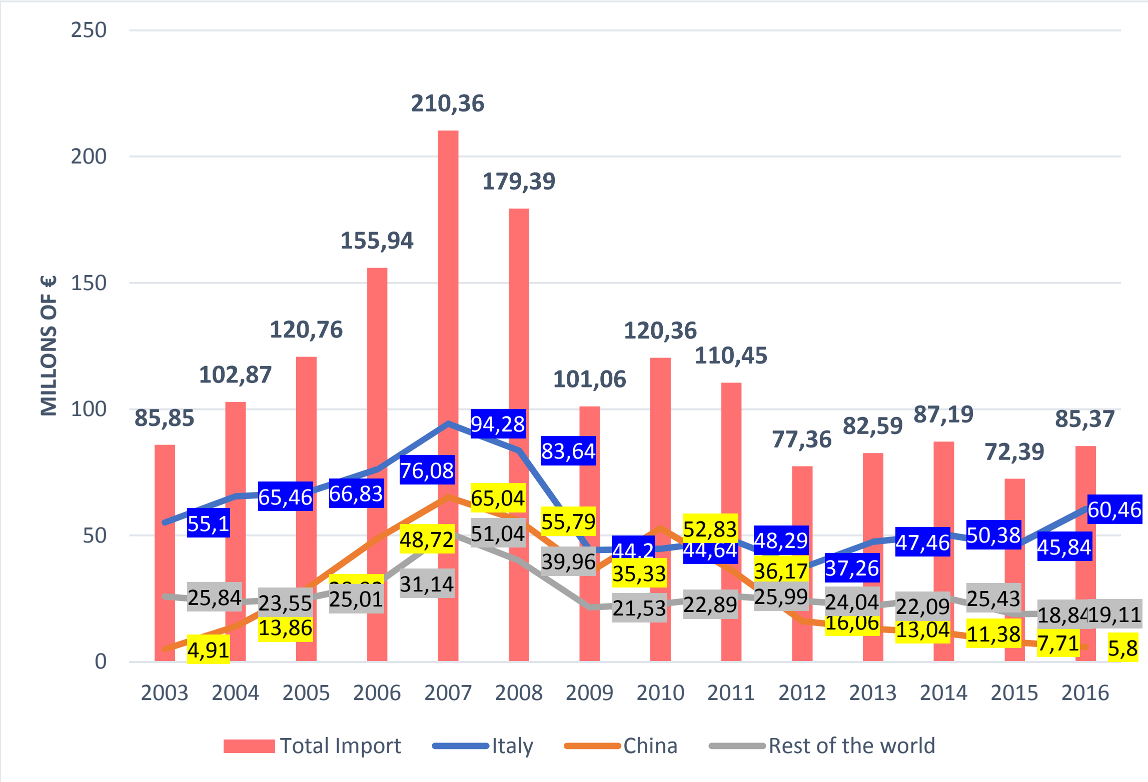


Source: DataComex, 2017

In the first graph we see how exports have been, on average and during the last 14 years registered, 19 times higher than imports and as in the years prior to the crisis, at the maximum point of import/export, to a 9%.

The last question that remains to be solved in this chapter is about the origin of imports. In this case, we have focused on the other two major world industries; the Chinese and the Italian:

Graphic 16. Origin of imports



Source: DataComex, 2017

We can conclude that, in the case of the Italian industry, it has been affected by the financial crisis of 2007 although, from 2009 onwards, it has begun to recover, gradually and rather slowly. On the other hand, the Chinese industry, following the Italian one, was affected by the first two years of the crisis, although in 2010 it had a significant rise that was demonstrated in the following exercises as unsustainable.

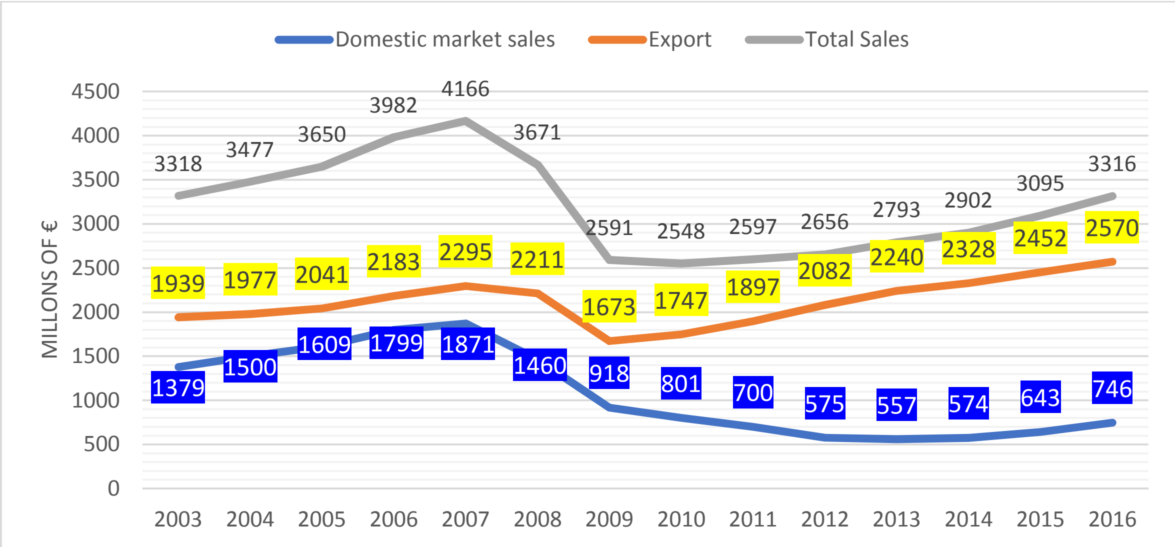
Thus, we can see that, although very lightly, the main industries, especially the Italian, have a small presence in the national market that evolves in accordance with the evolution of domestic consumption.

Exports

In this sub-section we will analyze the exports of the Castellón cluster; both the global evolution and the classification of the main markets and their respective trends.

First, we will begin by illustrating a comparison of total sales over the domestic and international sales of the last 13 years:

Graphic 17. Sales evolution



Source: ASCER, 2017

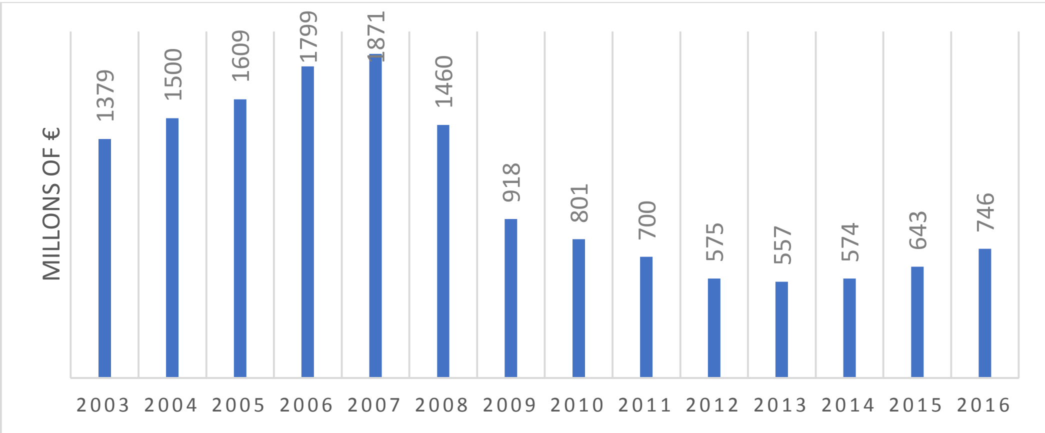
As it can be seen, total sales have been declining since the outbreak of the crisis in the fall of 2007 to 2010, due to the global recession of developed countries and especially the decline in consumption in the Spanish market. However, companies have been able to adapt to the economic scenario thanks to the search for new frontiers and markets in order to recover the positive numbers and return to the upward trend. We see how, while domestic sales have been decreasing well into 2013, showing signs of recovery from the 2014 fiscal year, exports have been the ones that have allowed the total increase in sales, characterized by sustainable growth since approximately the year 2009 to the present.

Regarding the impact of the economic crisis on the sector's billing, we saw a decline of 1,618€ millions from the 4.166€ millions in 2007, before the crisis, to 2,548€ millions in 2010, symbolizing a drop of approximately 38.8%. As of 2016, the last year with registered data, we see how sales have resumed the positive path, reaching the figure of 3,316€ millions, or what is the same, 80% of the best recorded billing (2007).

National markets

In this other illustration we can more easily see how trade in the sector has gradually become independent of national consumption to become a multinational industry.

Graphic 18. Domestic market sales evolution

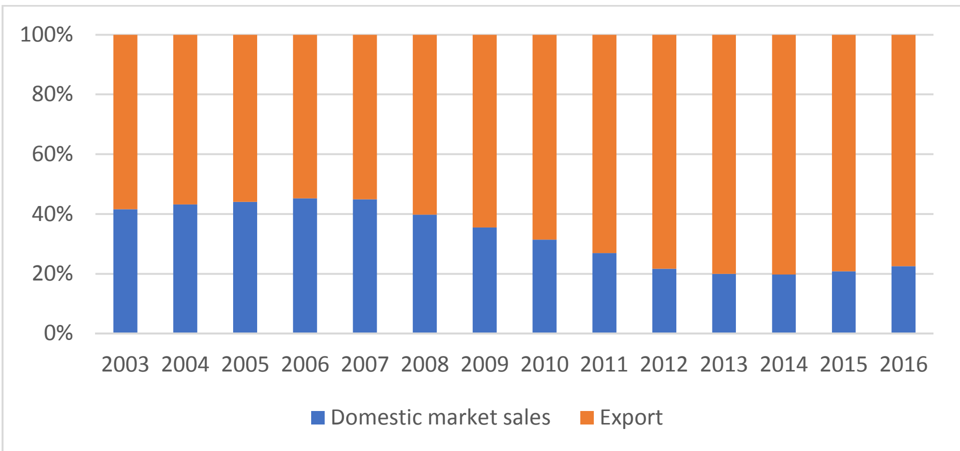


Source: ASCER, 2017

Sales in the domestic market have been affected by the economic crisis suffered since 2007, assuming a steady decline until 2013, from invoicing 1871 million euros to 557 respectively, or what is the same, in 2013 has been achieved to sell 29.7% of what was sold in 2007.

Regarding the percentage of national sales over the total, we see how these have been decreasing over time, going from valuing approximately 45% in 2007 to barely 20% by 2012, which represents a drop of 25% in just five years.

Graphic 19. Sales distribution evolution



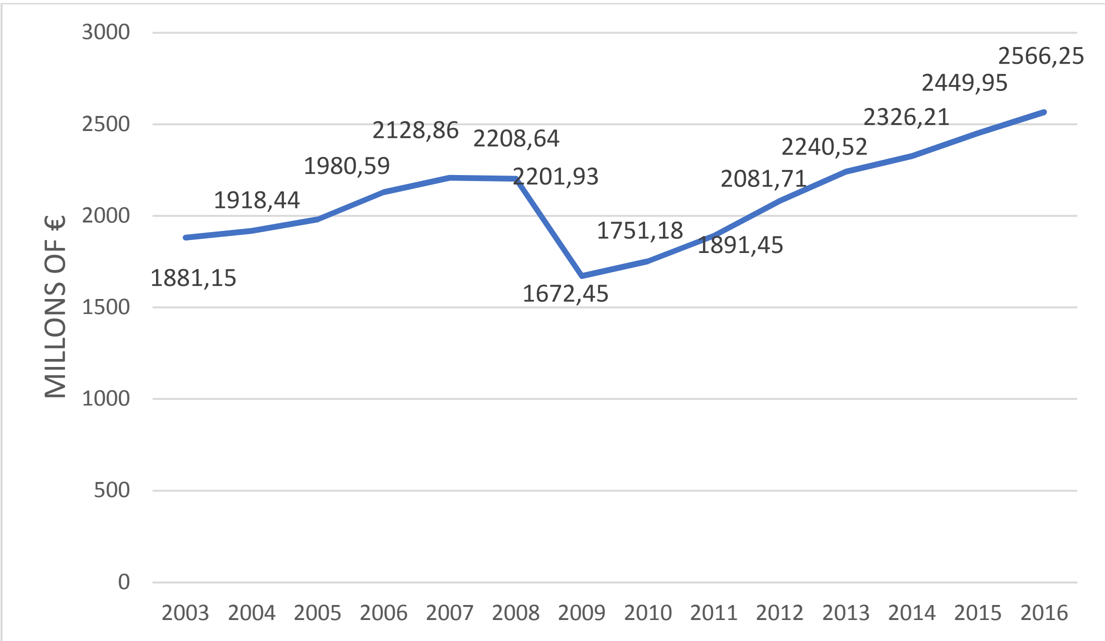
Source: ASCER, 2017

In the last 4 years we noticed a slight increase of 20% to 22% to stand at 746 million euros in the last year registered (2016). As the Spanish economy strengthens its recovery, consumption will be reactivated and if more is wagered on reform and rehabilitation, it could be revived.

International Markets

At the moment Spain is, in volume of sales, both the first producer and the first ceramic exporter of the EU, ahead of Italy, and second world exporter, only surpassed by the China producer. Aside from that, the ceramic sector, as of 2016 is the third industrial sector that has the highest trade surplus contributing a total of 2.570 million euros to the Spanish economy.

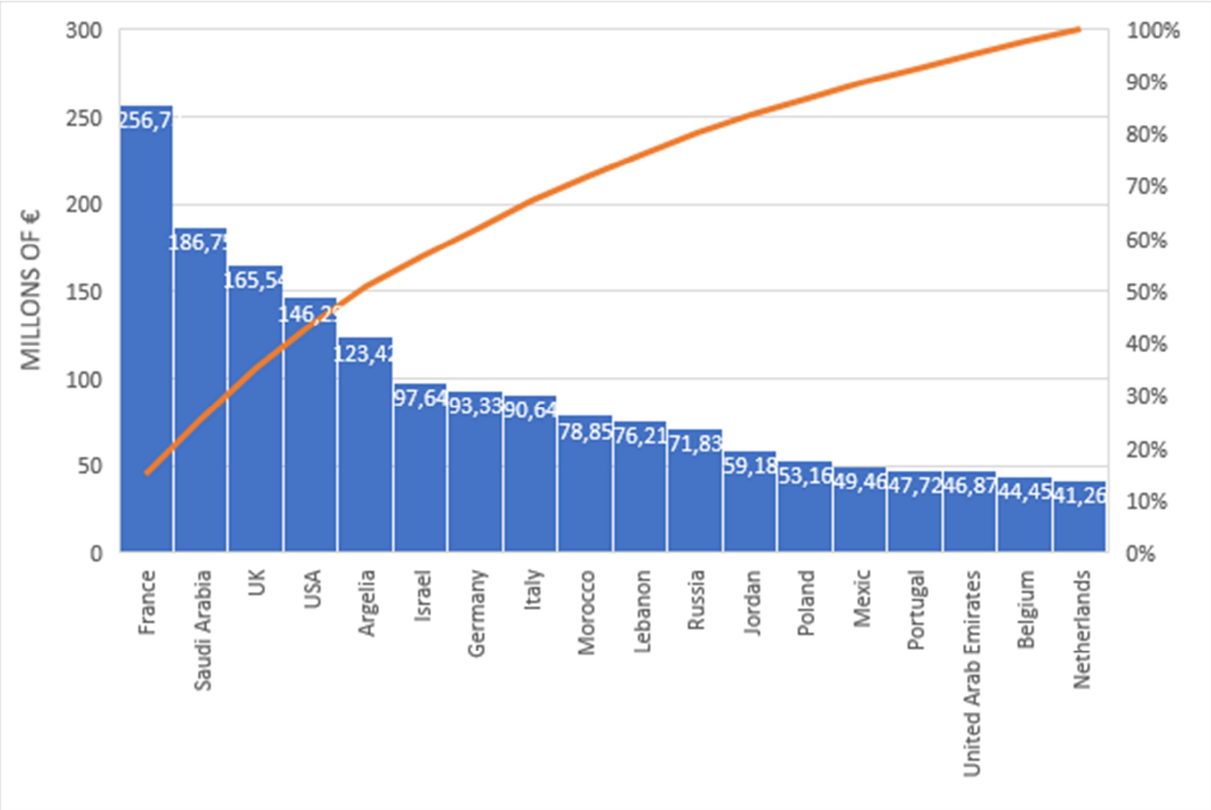
Graphic 20. Worldwide exportation evolution



Source: ASCER, 2017

Regarding the historical sales figures, we can see how a clear upward trend has been maintained in terms of international sales, with an increase in practically every year since 2009, rising from the amount of 1,673 to reach the incredible sum of 2,570 in just 7 years, an increase of 54%.

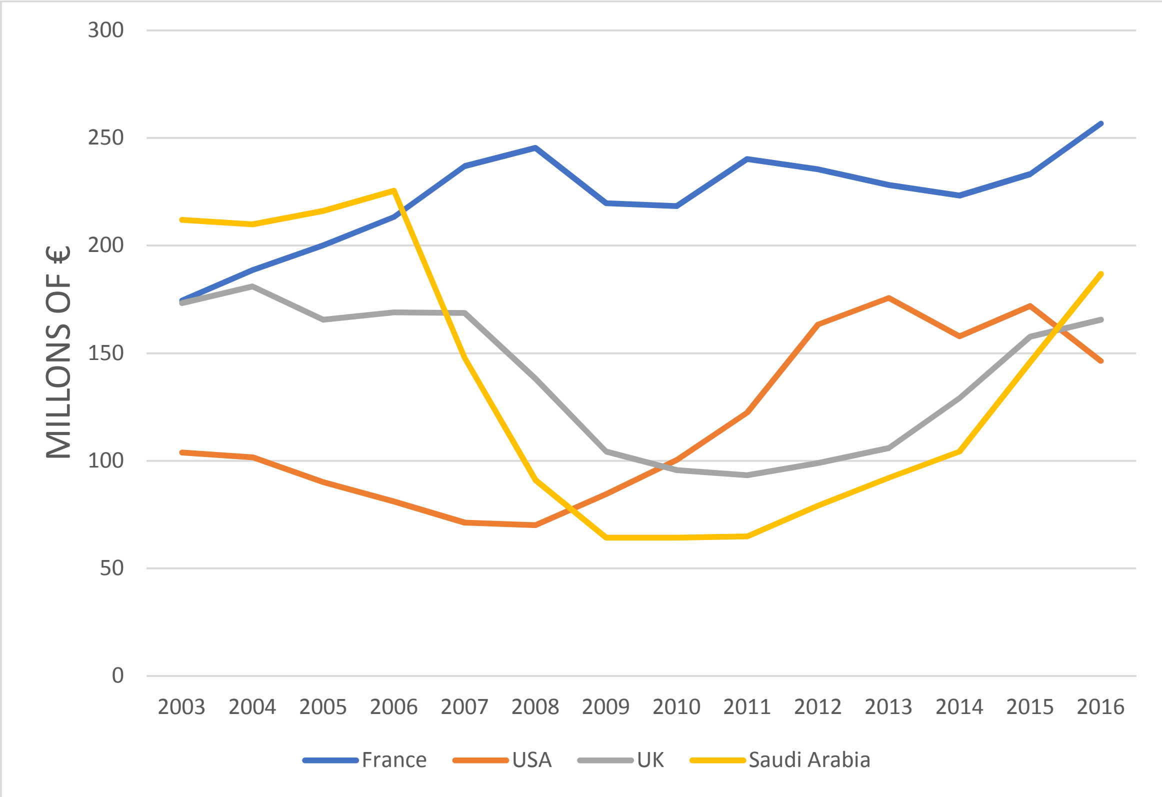
Graphic 21. Main export destinations in 2016



Source: ASCER, 2017

As it can be seen, the French market is the main export market, and as of 2016, the main sector, accounting for around 250 million euros and constituting 17.5% of total exports. Secondly, it is followed by Saudi Arabia with a turnover of around 170 million euros, the United Kingdom with 160 million euros, the United States with 149 million and Algeria with 125 million. Then we find countries like Israel, Germany, Italy, Morocco, Lebanon, Russia, Jordan, Poland, Mexico, Portugal, United Arab Emirates, Belgium or Netherlands. We have to highlight that the 4 main markets; France, Saudi Arabia, the United Kingdom and the United States make up 50% of the sector's total exports. Next, we will analyze in more detail the evolution of these markets in the recent years.

Graphic 22. Historical evolution of the four biggest international markets



Source: DataComex, 2017

As we can see, the 4 main markets have evolved irregularly in the last 13 years. The French market has been characterized by a light and regular growth, with the exception of the first years of the crisis, from 174.4 million euros in 2003 to 256.7 million euros in 2016, symbolizing an increase of 47.2 %. As for the American market, following the economic crisis it has increased, passing in 5 years from 70.14 to 175.7 million euros; an increase of 250%. The Saudi market has been very irregular, suffering a decrease from 225.4 thousands to 64.27 (72.5%) in just 3 years to regain the growth path until returning to 186.8 in 2016. Finally, the English market has also been characterized by an economic deterioration from 168.6 thousands to 93, 21; a fall of 44.7% in 4 years (2007-2011) to recover the pre-crisis figures by the year 2015.

Positive Markets

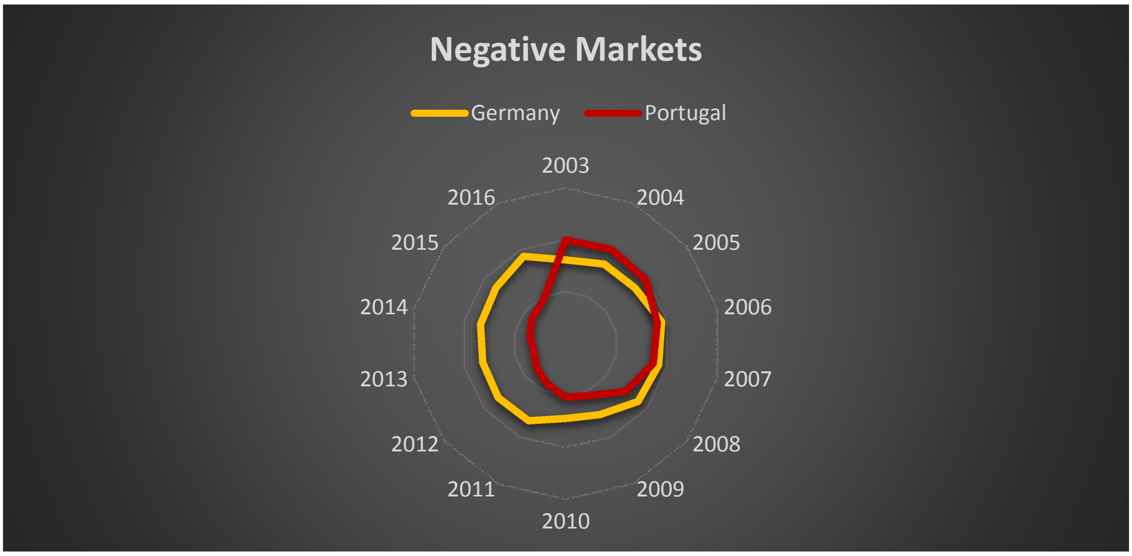
Graphic 23. Positive markets

Source: DataComex, 2017

As main growth markets, Jordan, Lebanon, Morocco, Israel and Algeria stand out in increasing order. The growth of these 5 countries has been 407.7% over the last 13 years, from a billing of 106.76 million euros in 2003 to the incredible sum of 435.3 million euros. The time of greatest rise was between 2011 and 2015, from 229.07 million to 419 million, or what the same is, an increase of 182.9% in just 4 years. As mentioned above, the markets of Algeria, Israel and Morocco have been the main drivers of this growth. In the case of the Algerian market, since the outbreak of the 2007 crisis, the amount of exports has practically increased multiplying by five, going from 27.12 million to 131.81 in 7 years. In the case of the Israeli market, the increase was from 42.2 million in 2009 to 89.87 in 2013 and from 35 million in 2011 to 79 million in 2016 in the case of the Moroccan market.

Negative Markets

Graphic 24. Negative markets



Source: DataComex, 2017

The main negative case is the Portuguese market, whose turnover dropped from 98.7 million euros in 2005 to almost 31.5 million euros in 2013, a drop of 68%. The most severe period of time coincides with the outbreak of the crisis of 2007 where, in the four years thereafter, billing was practically cut in half. We recall that Portugal was one of the EU countries whose economic situation forced them to request a bailout from the European Bank.

In this respect, the German market, which is the most important example of the economy of continental Europe, is notoriously important, although it shows signs of weakness in the early years of the financial crisis, soon the trend was reversed. This reduced about 20 million euros in just 3 years, although, from the year of 2011 returned to the positive course reaching the 2016 year to mark a new record of billing.

Unstable Markets

Graphic 25. Unstable markets

Source: DataComex, 2017

The cases of the market in Saudi Arabia and Russia, where economic and political instability has irregularly influenced the evolution of its sales in recent years, are strange.

In the case of the Arab market, we appreciate how at the date of 2003 there was a billing of 211.93 million euros that contracted to just 64.27 million as of 2009. After this drop of approximately 70%, the market resumed the positive growth path, reaching, as of 2016, the amount of 186.75 million euros of billing.

More extreme is the Russian case, this market, during the 14 years studied, has suffered two drops and two increases in its billing. From 2003 to 2008, billing increased from 51 million euros to 160 million euros, which represents an increase of 320%. The economic crisis also affected the large Russian market, dropping in only one year from 160 million euros to 79.14 million euros in 2009. The positive trend was again reflected in 2010, 2011, 2012 and 2013, marking a record of 169 million euros to go back in subsequent years to the figure of 71.83 by 2016.

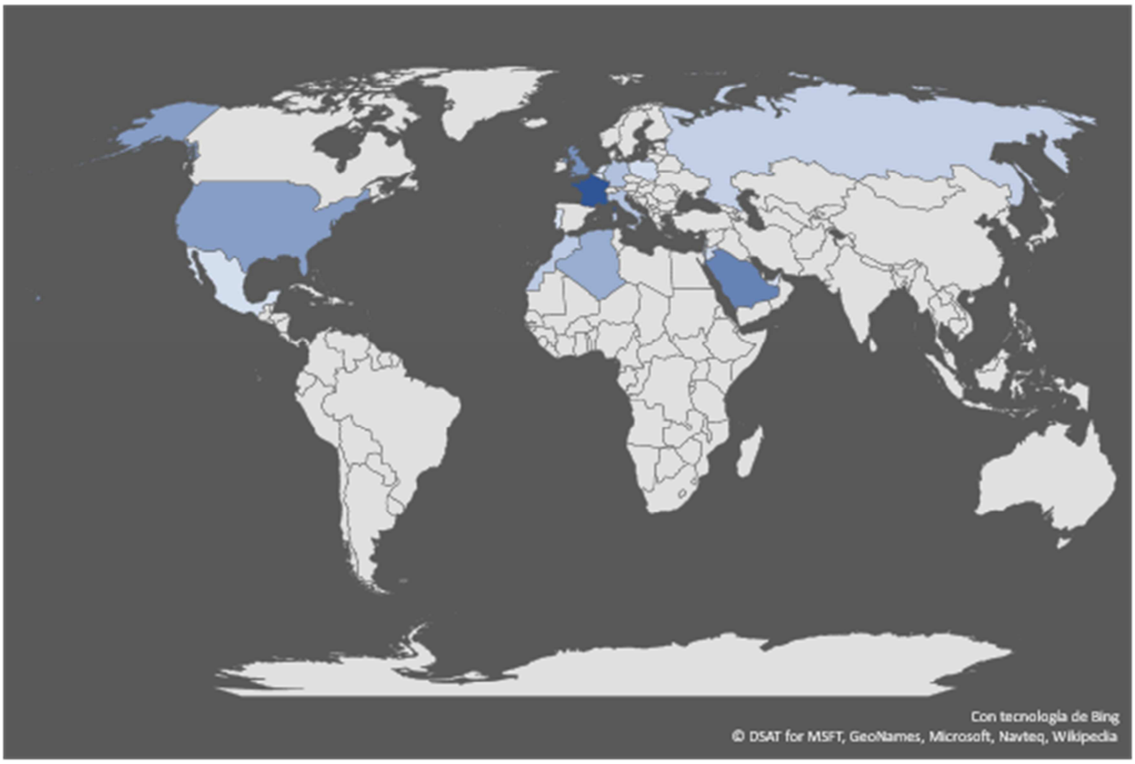
2.4 Logistics

Finally, we will analyze the way in which the logistics process is carried out. This chapter is divided in three parts; main destinations, media, and the Mediterranean corridor. We will start from the exhibition of the main receivers, thanks to the previous analysis regarding the export to give an idea about the main routes used by the industries of Castellón (we will focus on the distribution of the final product). Subsequently, we will address the subject of the means of transport preferred by industry by means of a brief description of the infrastructure we currently have (land, rail and naval) in Castellón. We identify the main factors favoring the choice of one mode of transport over another. Finally, we will present the project of the Mediterranean corridor, discussing the proposed initiatives and making a brief analysis of the implications and repercussions that this project can have on the ceramic cluster.

2.4.1 Main Destinations

As it has been previously stated, the main international destinations, as of 2016, are (in descending order) the following: France, the United States of America, the United Kingdom, Saudi Arabia, Algeria, Israel, Germany, Italy, Morocco and Lebanon.

Graphic. 26 Main exportation destinations



Source: DataComex, 2017

2.4.2 Means of transportation

When choosing the means of transport, the ceramic industry of Castellón faces the dilemma of choosing transporting the goods via land, being able to choose between the trucks or railway, or naval route.

A recent study by the GVA, on the economy of the Region of Valencia, gives us indications as to what are the main factors when choosing means of transport.

When deciding between railway and ship, factors such as size of shipment, timing and frequency are favorable to the choice of the railroad, allowing greater flexibility due to its smaller size and greater frequency of travel. On the other hand, factors such as unit value, transit time or reliability are aspects that favor the ship. In other words, if the distance is long and takes a lot of time, it will positively influence the choice of the ship. While the railway medium is more favorable to an urgent order of small quantity and in a nearby location.

In the case of the rail-ship comparison, we can observe how the demand of the railroad in relation to the truck stands out for being very sensitive to changes in the temporary flexibility, factors of cost and unit value, safety, transit time, average size of the shipment and the volume of cargo, leaving behind the company's size and the distance. This can be due to the fact that the truck is the means of transport with higher incidence rates, while allowing the transport of a smaller quantity of goods, which increases unit fixed costs and, consequently, transportation costs. However, factors such as a decrease in the frequency, flexibility of load and temporary or speed, favor the choice of truck.

As an example, if we had a sporadic order, with a well-defined quantity and without the need to carry it out urgently, we choose the truck mode transport, otherwise, we choose the railroad.

In global terms, if we compare the flexibilities of the probability of choice in favor to the railroad in relation to the ship and the truck, for the same variable, it is observed that in both cases the essential factors for the substitution of the current alternative for the service are related to transit time, speed and unit value, temporary flexibility and reliability. ((AVE), 2012)

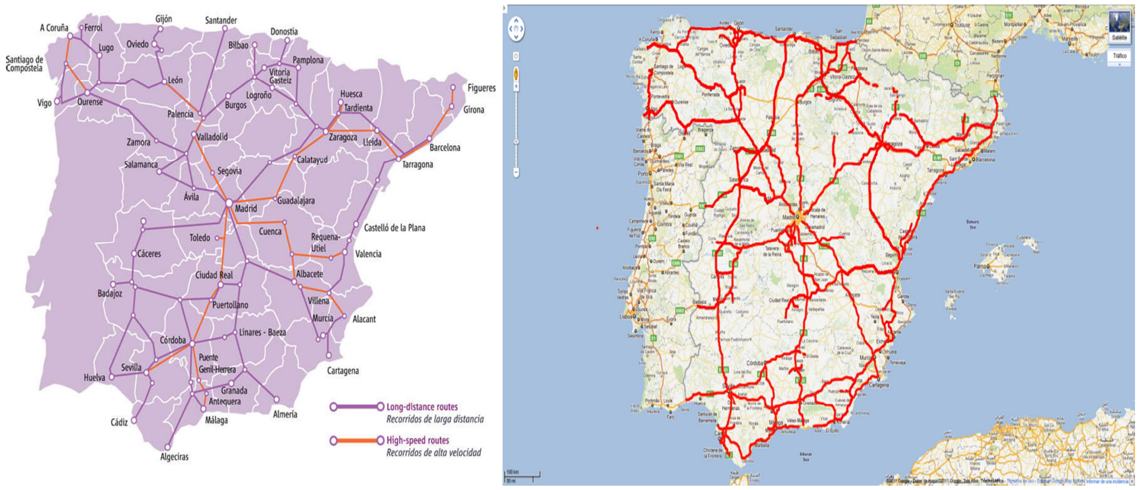
Land transportation

It is not easy to make an accurate diagnosis of the land logistics situation because it is a very irregular activity, which may vary due to variations in supply and demand, seasons or any type of anomalies or accidents. Apart from that, it is very complicated to obtain real data of the ceramic companies' terrestrial transport, so the real analysis will be carried out on the naval transport, having as reference the port of Grao of Castellón.

A noteworthy fact of the situation is provided by the ASCER's employers, in which it is claimed that, by sea, from the port of Grao is carried out approximately "70%" of the tile export, and the remaining 30% is carried out via truck and rail.

Below we have a map of the infrastructures of the rail network and motorways of Spain:

Illustration 18. Ground transportation infrastructure



Source: Renfe and Google Maps, 2017

As we can see in the illustrations, it is well known that the Spanish transport network is characterized by having a radial form, that is, the main roads are intertwined in Madrid, the center of the peninsula. Thus, we can conclude that the main transport routes are: in the south, through Valencia, towards Madrid for transports directed to the center of the peninsula; towards Murcia to the south; or towards Zaragoza to the north; while in order to leave the peninsula, the main road both by rail and by road is passing through Barcelona.

Shipping

There are currently 3 commercial ports in the province of Castellón: the port of Grao of Castellón, the port of Burriana and the port of Vinaroz and, additionally, I would also like to highlight the port of Sagunto because of its geographical proximity, however, due to its size and proximity, we can easily deduce that the main port used by the cluster is Grao of Castellón.

To analyze the naval transport there is a generalized classification method that divides the products according to their characteristics in: solid granules, liquid granules, general merchandise in container and general merchandise without container. In this case, we must focus on the transport of goods packaged in containers since the main ceramic product exported the tile, is very fragile and needs to be treated with caution.

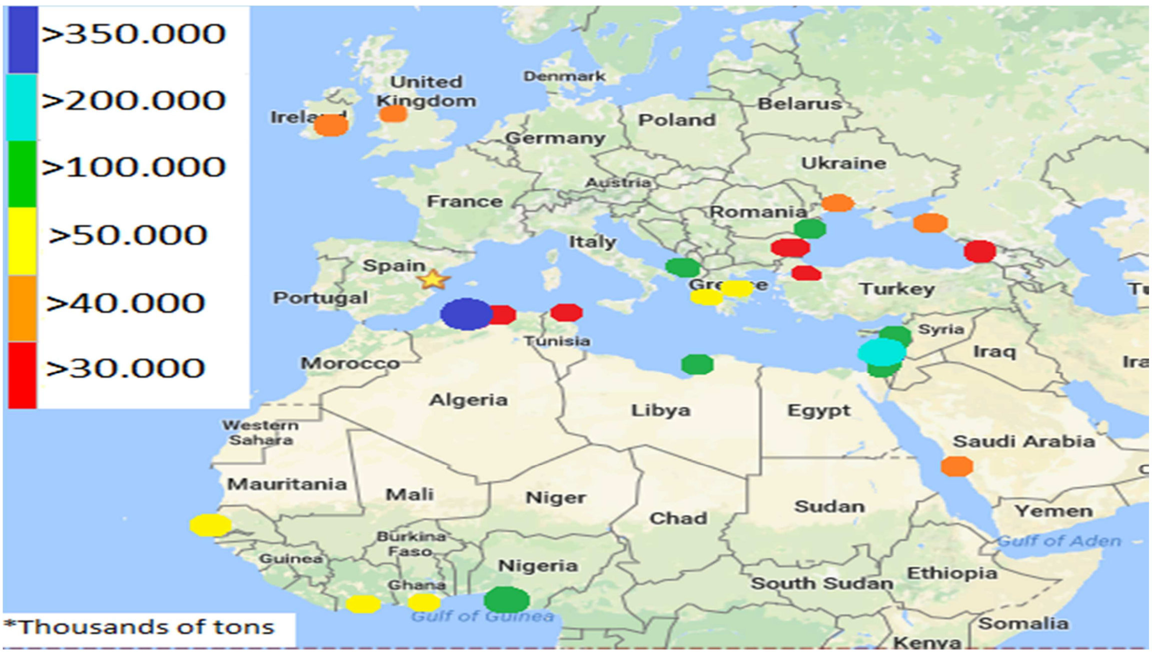
These have been the main ports of destination of the year 2016, with their respective weights:

Graphic 27. Port de Castelló main destinations per sea ports

Source: PortCastelló, 2017

As an illustration, we can see in the following map the main destinations of the port of Grao with their respective degrees of involvement in the export of goods in containers to dates of 2016.

Graphic 28. Localization of main destinations



Source: PortCastelló, 2017

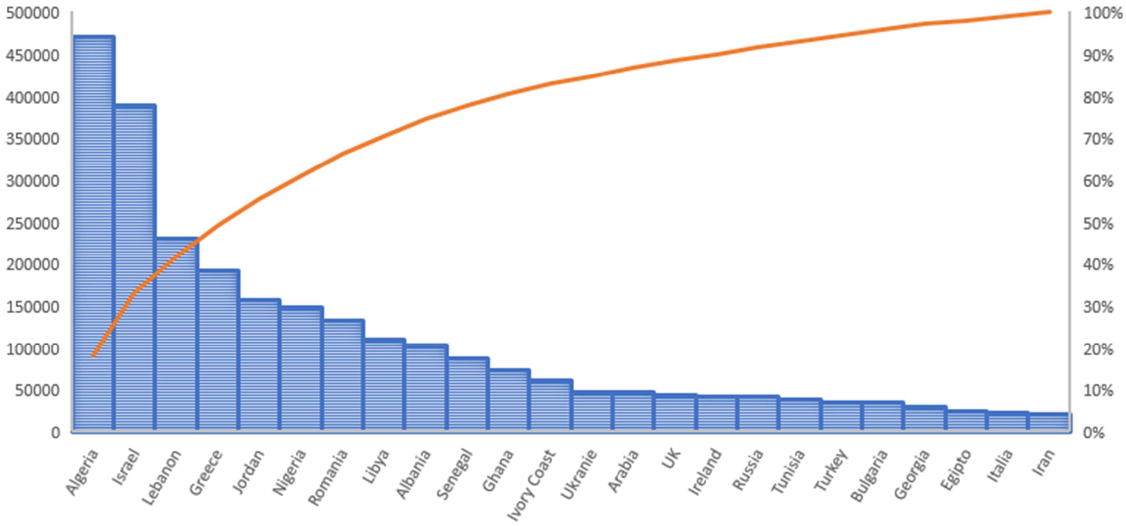
As a favorite destination, the port of Alger (Algeria) stands out, with an export in 2016 of 377,966 thousands of tons, constituting next to Misurata (Libya), Bejaia (Algeria) and Sfax (Tunisia), the main entrances to the North African market. Statistically, we can say that 1 of every 5 cargoes of packaged goods that part of the port of Grao of Castellón are destined to one of these commercial ports.

Following the port of Alger, we find the port of Beirut (Lebanon) as the main trading partner of the Middle East area with an export in the last year of 231.210 million tons. Together with the ports of Ashdod (Israel), Aqaba (Jordan), Haifa (Israel) and Jeddah (Arabia) in the south, they constitute the largest shipping trade with the port of Castellón (1 in 4 shipments), being the entry to the Middle East market. However, we highlight that, due to numerous armed conflicts, this is a socially unstable zone.

The other notable areas are in the south-east European area where the ports of Constanta (Romania), Durres (Albania), Thessaloniki (Greece) and Piraeus (Greece) among many others, constitute 20% of exports; the Gulf of Guinea, which connects Castellón's market with the sub-Saharan market, with the main ports being the ports of Lagos (Nigeria), Dakar (Senegal), Abidjan (Ivory Coast) and Tema (Ghana), accounts for approximately 13% of shipments; and British Isles through the ports of Dublin and Liverpool.

The Maghreb areas together with the Middle East countries constitute an important part of the total sales of the sector due to both geographic and especially cultural reasons, since they are countries that have a long tradition in decorating and using ceramic elements. Apart from these two influential places, we have the area of the Balkans and the surroundings of the Black Sea where apart from the preference of consumers for ceramics, stands out for not having a very optimum terrestrial infrastructure, which benefits the choice of naval transport to reach those areas. Another key point are the islands of Great Britain where due to the distance and good naval communications, it is more beneficial to land in the ports of Liverpool and Dublin. Finally, we have to highlight the sub-Saharan zone, where the consumption of these products is also on the rise and transport is being carried out in a naval way as there is no real alternative transportation.

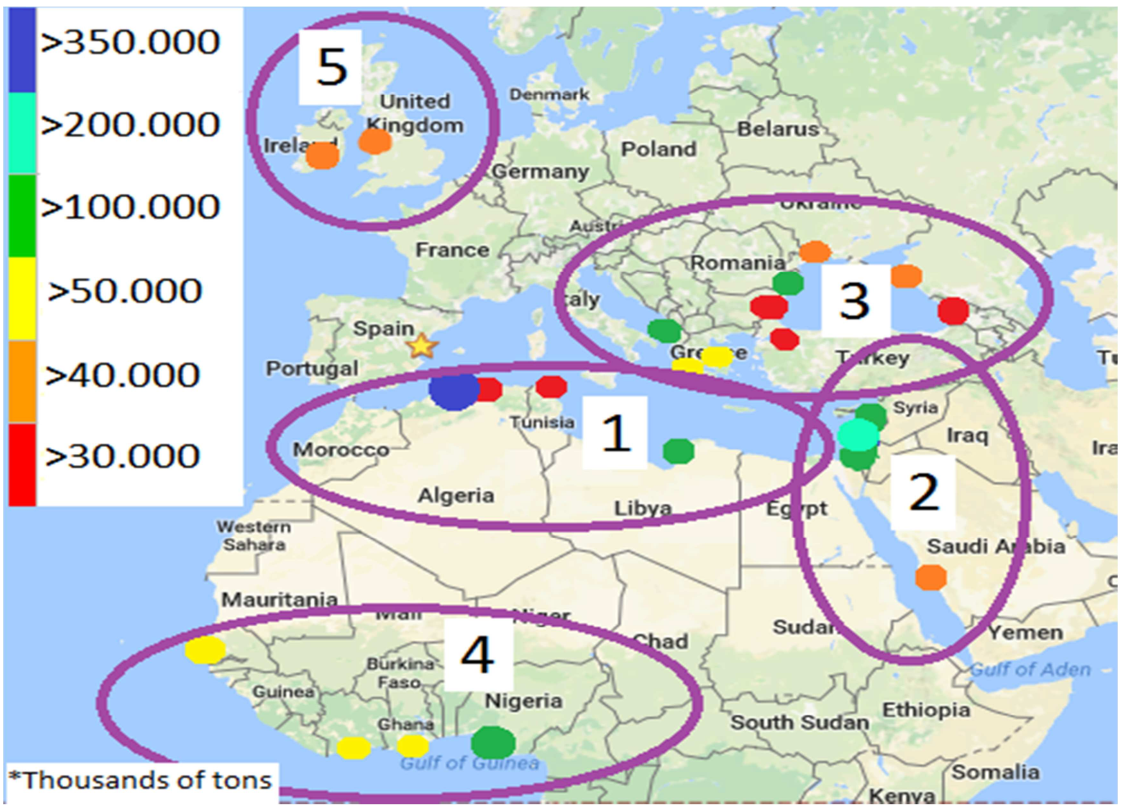
Graphic 29. Port de Castelló main destinations per country



Source: PortCastelló, 2017

Taking into account the above analysis, we can classify naval destinations in five large areas: North Africa, the Middle East, Sub-Saharan Africa, Southeast Europe, and the United Kingdom.

Graphic 30. Main areas of navy traffic



Source: PortCastelló, 2017

It should be noted that the results for the first quarter of 2017 have already been published, reflecting very positive data on merchandise traffic, with a container growth of 17.7% compared to the previous year and overall traffic growth of 10.9% 354,184 tons, beating a high record in April.

2.4.3 The Mediterranean Corridor

It is a project that has been investigated for many years, whose main objective is the improvement of the transport infrastructure corresponding to the Mediterranean coast, specifically from Figueres (Girona) in the north-west of the peninsula to the port of Algeciras, Cadiz. Given the great magnitude of the project, this is divided by sections and we are particularly interested in the two sections connecting Castellón and Vandellós (Tarragona) in the north and Castellón and Valencia in the south. We will focus more on the section connecting Castellón with the North as it is a key gateway to connect it with Europe via land.

<u>Castellón – Valencia Section</u>

The initiatives of this journey are as follows:

- ESG in the conventional line (immediate / short term).
- New access to the Port of Sagunto (short term).
- Intermodal Terminal in the Parc Sagunt (medium term).
- High Speed Line Castellón-Valencia (medium / long term).

Taking into account that the export by sea is being carried out mainly from the port of Grao of Castellón and Burriana, we discard the two projects referring to the city of Sagunto, as it does not constitute a strategic logistics point for the ceramic sector of Castellón. As for the high-speed line, it is also not relevant as a means of civil transport and not of merchandise that is expected to have almost no impact on the performance of the industry.

What is of our interest is the progress of the improvement in the conventional rail line from Castellón to Valencia. Although it can transport merchandise towards the south of the peninsula, it is important to emphasize that this section is relatively insignificant to cover only the southern part of the Iberian peninsula, unlike the northern section, which is symbolized the door to the European market, much greater in numbers.

Vandellós-Castellón Section

On the other hand, for the section Vandellós-Castellón these are the main initiatives proposed:

N-340 road with 4 lanes (medium term)

ESG in existing line, but ESG / IG (Iberian gauge) in one of the two ways (short term)

New access to the Port of Castellón (short term)

New high-speed line (medium / long term)

Regarding the expansion in two lanes of the N-340 road we consider that it will serve to lightly decongest the traffic for the transport in lorry and therefore would have a positive impact on the logistic cost of Castellón's ceramic sector for its export to Europe. On the other hand, the high speed line is exclusively for civil use therefore it cannot be taken into account in this analysis.

A relevant project for the sector is the new access to the port of Grao de Castellón. This is an initiative to link the CV-22 highway to the north-east of Castellón, thus completing a peripheral circuit to the city, arriving this way to save about 30 km to some trucks that have interest in accessing the port through the North. We remember that some of the main locations of the main companies of the cluster are Vall d'Alba or Sant Joan de Moro or Alcora, being these in north direction to the one of the port of Grao of Castellón.

Illustration 19. North access to the port project situation

Source: Proyecto básico, Estudio de impacto ambiental y estudio de integración paisajística. Obres Públiques, GVA

However, the project with the greatest impact for the industry is to create an additional lane in the rail network of the European standard. We recall that since the introduction of the first railways in Spain in the mid-19th century, due to political and economic reasons these have been designed with a different track width than the European standard, making it difficult to connect Iberian trains with the rest of the Continent and consequently creating delays and increasing the costs to commercialize with the rest of Europe via train.

Thus, these initiatives would favor the FERRMED project, whose mission is to create a close train connection across Europe, from the Strait of Gibraltar to the Helsinki area. Several studies claim that this area covers around 70% of European economic activity, so an improvement in the communication of these infrastructures is a very important step towards the global competitiveness of the European area. The additional rail on the European standard rail network would make Europe a better connected economy zone.

Illustration 20. FERRMED Great Axis Network project

Source: FERRMED

The forecast of the study carried out by GVA on the effects of the Mediterranean corridor on the competitiveness of Valencia’s economy indicates that, with the functioning of the Rail Corridor in 2015, Valencia’s company could have saved transport costs up to 40% between 2015 and 2025 while other studies claim that approximately 900,000 tonnes of CO_2 emissions per year could be reduced to the atmosphere.

3. CONCLUSIONS

To conclude, the industrial ceramic cluster of Castellón can be classified as geographic and horizontal because it is very concentrated geographically in the province of Castellón and with companies involved in all the stages of the value chain. Economic data indicate that, in addition to being the economic engine of the province of Castellón, it is also one of the industries that have the largest surplus in the Spanish economy and although, as a result of the crisis, there was a drop in sales, signs of recovery in recent years have been present.

Apart from that, we have seen that a cluster is not exclusively composed of economic organizations, but also public institutions and training centers play a very important role. In this case, associations such as ASCER, The Ceramic Institute, ICT (Institute of Ceramic Technology) or the Association of Ceramic Technicians, among others, that are in charge to support the activity of the companies.

We have seen how the production process of ceramics involves several phases ranging from atomization to the decoration of the final product, through companies of frits, enamels and dyes, tile manufacture or machinery companies. We have also concluded that tile makers make up the bulk of the ceramic tile industry and have compared the average economic data of the main companies of the sector to observe how, after the economic recession of 2007, they have given several indications of reaching numbers prior to the crisis.

Moreover, we have presented the final product and the variations that can present as mosaic, type of paste (red or white), the type of stoneware or the rectification or not of the tile. Apart from that, we have presented the main stylistic trends currently on the market. Additionally, we have analyzed the promotional strategy carried out by Spanish, Italian and Chinese companies and we have concluded that the positioning of the Spanish companies lies in the innovation, the Italians in the tradition and the reputation, and the Chinese in its size and potential. Afterwards we have entered the commercial analysis of the sector. We have illustrated the evolution of the imports and how the numbers are smaller than those of the exports. Regarding exports, we have identified the main international markets: France, the United States of America, the United Kingdom and Saudi Arabia, as well as those with the best evolution (Algeria, Israel, Morocco and Jordan), those with the worst evolution (Portugal and Germany as representatives of the European market during the crisis) and the most unstable (Saudi Arabia and Russia).

Moreover, we have focused on the logistics process. In this part, the main destinations of the exported product have been listed; being France, the United States of America, the United Kingdom, Saudi Arabia, Algeria the main destinations. The entrepreneurs' preferable ways of transportation depending on the characteristics of the transport have been discussed. It has been concluded that they adopt a radial model. Therefore, we have identified the main ports of destination for the merchandise from the port of Castellón (the port of Alger and the coast of Israel), and its respective evolution. Finally, we have discussed on the project of the Mediterranean corridor; what it consists of and what potential impact it has on the ceramic cluster, concluding that some projects such as the additional lane on the railway to TAR and the access to the port of Grao through the northern part can considerably reduce transport costs and thus benefit the sector.

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