

**UNIVERSITAT  
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**CREATIVITY AND INNOVATION IN THE CERAMIC  
TILE INDUSTRY**

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**CASE STUDY: STRUKER PORCELANICO.S.L**

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**1. INTRODUCTION**

The world we live in today is a globalized world, where events are happening faster and faster, businesses are increasingly competitive, and customers are much more specialized and expect a high performance of the product they purchase. All these aspects together make it necessary for companies to differentiate themselves from their competitors, and one of the ways they can choose to create this competitive advantage is by using innovative tools. It is currently very difficult for a company to survive in such a competitive environment without differentiating itself from its most direct competitors. These advantages we are talking about are necessary even in the most mature sectors, such as the one we will analyse in this paper, the ceramic sector.

In this project we will try to understand the importance of concepts such as change, creativity and innovation, and the relationship between these three, understanding them as parts of a process, discussing the importance they can bring to a company in such a competitive sector as the ceramic industry. We will analyze the industry and the weight that the Cluster of Castellón has on it, developing here 95% of the national activities of this sector.

In order to try to know, in a more practical way, the implantation of the innovations in companies of the sector, we will study a practical case of how a small company integrated in the Cluster of Castellón tries to differ from the competition by means of the adoption of one of the last technical applications of the sector.

Specifically, we talk about the company Strucker, a small company but with a high desire to innovate, giving an example of how it is possible for a small company to survive against large existing firms in the sector, thanks to innovation.

The implementation of LaserJet technology in the company and its development will help us to understand the importance of innovations in quality and design, and why the Spanish ceramic industry has been a world leader in these aspects for several years, differentiating itself from other world powers and becoming one of the world powers in the ceramic sector.

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**2. CONCEPT DEFINITION**

A good way of understanding that innovation cannot be left at random and that other concepts, such as creativity and change, are closely related to that term is the story he tells us in his work (Ordoñez, 2010) about a French artist.

Louis Daguerre, a French painter who was not much in the media, but who was an enterprising and daring man who always faced his economic adversities with an innovative character, was at his residence in London in 1835, tired of investing hours and hours of effort trying to fix photographic images taken with a camera obscura (what would eventually be known as the Daguerreotype, which consists of forming the image on a silver surface polished like a mirror). Louis lost his patience completely, he was disconsolate and discouraged because he had tried many materials to achieve this revolutionary photographic procedure with the same result, failure. Daguerre definitely kept the plates and chemicals in a closet and thought about doing something else. After a few days, he took the plates out of the cabinet again and the images appeared clear because the mercury of a thermometer spilled on them by chance had fixed them.

This time luck was on his side and he managed to discover the properties of mercury, what led him to invent this type of rudimentary photography. As we mentioned earlier, it would be called Daguerreotype in his honour, an invention that would eventually produce both cultural and economic changes at that time. On the other hand, nowadays, due to the increase of the speed existing in society when creating new technologies and inventions in any of the fields and sectors of the economy, companies cannot afford to wait for the help of chance, as it was the case of the French painter.

The changes in the market do not give time to anyone, and the options to combat them are to offer resistance or to respond to them with an attitude of change, creativity, and innovation. The latter will be the terms that we will define next, as they will help us to understand better this study.

**2.1 Change**

In these times in which we find ourselves, fewer and fewer companies are trying to maintain stability, and those that seek it, end up coming to a standstill without progressing in the quality of their products and, consequently, this factor is reflected in the fall of their sales. In

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this era change is part of everyday life, or as Ordoñez (2010, p.17) indicates "change is the hallmark of life today, and whoever resists it will inevitably be out of system". He also tells us that "everything that seems unchangeable can be changed radically".

Therefore, when those people who occupy high executive positions and must take decisions in an organization try to stop these changes, they will end up producing negative consequences, both for themselves, since it may lead them to lose their jobs, and for the company, since it may suffer a disadvantage compared to its competitors if they are not aware of new dynamics or changes.

#### **2.1.1 Concept**

The causes of change in a company can be external, which are those that correspond to changes that are caused by factors external to the organization, or internal corresponding to changes generated from within the organization itself. In this case, we are going to contextualize this concept in a framework where the main cause of it is internal, and this is Innovation. We can understand change at a business level, as Duarte (2008, p.1) explains, as "the process by which a certain state of things is succeeded by another state". From this basic and general definition, each field of human knowledge adapts a concept of change that is appropriate to it, so we can talk about this concept not only in terms of business change, as it is our case, but also in biology, philosophy, medicine or many other terms.

#### **2.1.2 Organizational Change**

In our case we have to take into account that the change will be produced by the adoption of an innovation, either at a productive level or at an organizational level, which can generate what we call an organizational change in the company. What do we mean by organizational change? It was defined by Malott (2001, p.16) "as a constant state of alteration, variation or modification" Such change, according to (Chiavenato, 2002) can be a modification that occurs in the work environment, translated into innovation in current organizations. From the point of view of these definitions, we can associate change with the capacity of adaptation that companies or organizations have in the face of the transformations that occur in the internal environment as well as in the external one.

On the other hand, for Barroso and Delgado (2000, p.126) "the change is a modification of the way of working that generates a leading role in the human resource and a real and expressed need of the individuals to accept it". With this definition we can deduce that



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change can be examined from several different points of view, such as organizational culture, strategy, political, structural and technological aspects and finally, from the behaviour of human beings, since their actions define the acceptance or rejection of organizational change processes.

Acosta (2002) indicates other reasons different from innovation for which an organizational change can occur, such as new administrative trends, environmental pressures, financial problems and market accommodation, strategic alliances, new technologies, transformations in the social, political and economic environment, world politics and global competition, among others.

#### **2.1.3 Models of organizational change**

With respect to the Models of organizational change, authors such as Novoa (2000) consider that the complexity of change, apart from the number of employees belonging to the company (the greater the number of employees, the more complex it is), comes from the types of models of change because there are some that allow convenient explanations and predict behaviour and others that do not. The author points out four broad models, each composed of several components.

The first model is the Humanist model, which depends on: people's change, currently considering a participatory management, therefore, leadership through communication and participation in decision making employees' commitment in an enabling environment; organizational development that usually begins with a diagnosis of culture and, then, establish a vision of change with the management; human development, which must take into account both individual and group aspects, emphasizing people's progress; self-directed or high-performance teams : the role of the managers for these teams is simply to transmit to them the knowledge they have acquired previously so that they can take the leadership in their own work and train them in their process of self-management. The second model is based on the concepts of effectiveness and efficiency, as well as aspects related to quality management, such as the ISO 9000 standards, which provide a set of guidelines, concepts and orientations for planning, organization and control. Therefore, as we can see, this second model considers the elements involved in changes focused on administrative changes fundamental. The third model is the process improvement model, which takes into

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account the phase in which the process acquires value at each step, regardless of the authority structure or departments: first the process, then the support of the organization (with positions, policies and procedures). Finally the fourth type of model, which are the types of models used in the XXI century, which involve the model of innovation and are based on the use of creative intelligence in all links of the company: once this intelligence has worked, they manage this knowledge, and the learning approach proposed lies in the capability to learn of the organization.

#### **2.1.4 Adaptation and resistance to change**

As he explains in his work (García, et al, 2010), one of the great challenges that companies face when modifying their work schemes and optimizing management due to the adoption of an innovative system is the capability to adapt to changes. Global organizations have had to transform themselves to adapt to the new market conditions. The real driving force that must develop this capability to adapt to a totally new work situation is human resources, one of the most valuable assets a company can have.

An organization's capability to change is important to ensure increasing market evolution, hence its success. One of the greatest challenges for the managers of any organization is how to successfully achieve that change that you have decided to make in order to try to lead your company to success in the very competitive markets that exist today. Two of the factors that are positively related to the innovative capability of an organization are anticipation and adaptation to changes, therefore companies must be proactive to meet market demand. On the other hand, it is important to emphasize the values that are part of the shared identity of the members that are part of that organization, so that the changes generate a transformative process, thus being another factor that helps to minimize resistance to changes.

#### **2.2 Creation**

One of the themes that today, as always, must accompany business activity is creativity, to find new options for action and possibilities for products or services offered.

Henry Mintzberg himself refers to a person's need to have flexible thinking as well as full of creativity and permanent innovation, as he considers these concepts essential in today's

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changing world in which we live. Henry is not the only one. Several authors reiterate that to succeed in any business activity where there is discouragement, pessimism and constant frustration, there must be a need to be permanently in constant creative development.

#### **2.2.1 Concept**

According to Ponti and Ferras (2008, p.38) it is known that "creativity is the human capacity to generate ideas or imaginative connections in a certain field, with a certain level of originality and value contribution".

Described in the words of the common man and giving this term a differentiation with respect to innovation, we can say that there is a relationship between creativity and the possibility of developing new initiatives of action that can be materialized in the so-called "creative ideas", while innovation is observed when one passes from thinking to execution, transforming these creative ideas into material realizations that can be seen in the market and marketing as he explains in his work (Hector Murcia, 2011). This same author, according to various reviewed opinions, defines creativity as "the capability to give rise to new products and services or improve existing ones and to form a new technology or adapt the existing one to the new needs of the market". He also expresses that it is a skill and attitude that is permanently in force and, due to the great number of accelerated changes that occur today, it is vital to maintain a constant creative attitude, recognizing that many of the things that worked in the past are not valid in the present.

#### **2.2.2 Personal competences and skills of the creative person**

Nowadays, in order to measure personal skills and abilities, some authors, such as (Ponti and Ferrás, 2008), have tried to explain them to creative individuals. In their work *Passion for Innovation*, they elaborate a series of competences that, according to them, constitute the profile of the creative person and that they are worth being analyzed from the beginning of any business activity to identify the characteristics with which each person is identified. By carrying out an individualized analysis of this series of concepts or competencies, and adapting them to a strategic measurement process, we will be able to establish the strengths and weaknesses with respect to each person's creativity, in order to strengthen the weak points through creative methods and tools that will be explained later. In chart 1, we can

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observe some of the competences of a creative person, according to the concepts of Ponti and Ferras (2008) :

Chart 1: Reference to indicators of skills of a creative person, according to the concepts of Ponti and Ferrás (2008)

PSYCHOLOGICAL SKILLS
1. To have the belief to be creative and that creativity can be developed.
2. Self-knowledge. Knowing your creative strengths and weaknesses.
3. Introspection. Enjoy peace of mind to analyze your creative condition.
4. High level of self-motivation.
5. Mental curiosity.
6. Logical thinking combined with lateral thinking.
7. Intuition and reason. Knowing differences in brain hemispheres.
BEHAVIOURAL SKILLS
8. Formulating problems and turning them into creative solutions.
9. Regularly search for creative ideas.
10. Transgressive attitude. Going beyond traditional situations
11. Adventurous attitude. Likes to take risks.
12. Have creative leadership to share with those around you.
13. Knowing how to think naively, expressing ideas in different ways.
TECHNICAL SKILLS
14. Learn about creativity methodologies .
15. He knows methodologies, systems and processes of innovation.

Source: Ponti, F. y X. Ferrás (2008). *Pasión por innovar*. Grupo Editorial Norma. Bogotá, Colombia.

**2.2.3 Barriers to creativity**

Based on the study by the author M.<sup>a</sup> Cinta Gisbert (2005, p.11), she defines creative blocks as "that set of schemes, ideologies, fears or deficiencies that prevent us from leaving the

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established way and which closes the doors to our imagination and our ability to perceive things from perspectives different from the traditional ones".

It is important to know the factors that lead to creation and this knowledge will they help the management of an organization to strengthen these factors, but it is equally important to create a climate that encourages the continuous creation of new ideas, without offering any obstacles or barriers. Most of these obstacles or barriers are found in unfavourable attitudes and behaviours, as well as in the lack of skills, both of senior management and of the rest of the staff of an organisation. Next, we will investigate the study of those elements, both personal and group as well as organizational, that can constitute a traumatic element of blockage or fear to the creative expression of the individual.

In the same study by M.º Cinta Gisbert we mentioned earlier, she does a synthesis of several works of the following authors; (Amabile and Gryskiewicz, 1988; Aznar, 1974; Buggie, 1984; De Guzmán, 1994; Groth and Peters, 1999; Hermida and Serra, 1989 a and b; Simberg, 1989; Von Oech, 1987; among others) with the purpose of grouping all those aspects that can lead us to block the creation in two groups, the personal or individual Obstacles and the contextual ones.

*Personal or individual obstacles:*

Within this subgroup of obstacles we will make another subdivision, since personal obstacles can be divided into cognitive and emotional obstacles.

The so-called cognitive are a consequence of attitudes or routine intellectual skills adopted by individuals that impede finding the solution to new problems. These attitudes are usually linked to knowledge that the individual has been acquiring through different experiences throughout his career, making it difficult to perceive various points of view of a problem and how to tackle them. Such attitudes are likely to cause mental rigidity in the individual by avoiding departing from pre-determined routines when devoting greater energy to gather information, considering that a defined basic idea or concept or the existence of a stereotype already exists.

On the other hand, personal obstacles of an emotional nature are those that refer to individual internal problems, personal fears and insecurities, feelings of guilt, fear of obtaining a failure, low self-esteem, low self-imposed limits, neurotic pressures, all kinds of

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problems related to a lack of self-confidence that lead a person to a repression of creative expression or a limitation of this, preventing the individual from manifesting his innovative facet.

*Contextual obstacles (group and socio-cultural) :*

We have talked so far about the blockages from a personal and individual point of view, referring only to the obstacles that an individual has to overcome alone, but these are not the only ones that affect creativity. There are obstacles that appear in the environment in which the individual develops, forcing an inability or involuntariness of the individual to be creative.

These contextual obstacles can arise from within the organization, since there are many situations in which creativity does not come to light due to the consolidated and unbreakable cultural rigidity of the organization over the years. The problem is not the lack of creative personnel, explained in another way, the origin of the problem does not come from the individual, but emerges from existing relationships with the rest of the organization's personnel, which we call group obstacles. On other occasions it is society that originates or imposes them, derived from the existence of certain regulations or values: these are the so-called socio-cultural obstacles. Considering the study ( Horacio, 2011), several of the obstacles, both personal and contextual, mentioned above are reflected in a more practical way in chart 2 below.

Chart 2: Obstacles on a personal level

OBSTACLES ON A PERSONAL LEVEL
1. Desire to keep doing only what he is told to do.
2. Not developing an idea for fear of rejection by superiors.
3. Having thoughts like "follow instructions to the letter".
4. Need to be practical for working against the clock.
5. Set yourself a limit by believing that you will never be able to get creativity because it is not your specialty.
6. Lack of creativity training.

*Source: Own elaboration*

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Chart 3: Contextual Obstacles

CONTEXTUAL OBSTACLES
1. Belonging to a group where there is not a good working climate.
2. To rely too much on your group mates to develop the innovative side.
3. Belonging to a company with a rigid structure, traditional in its rules.
4. Possible difficulties in justifying and communicating your ideas.
5. A desire not to depart from sociological and cultural norms in order to be accepted.
6. Desire to adapt to an existing culture and not let your creativity be developed.

*Source: Own elaboration*

**2.2.4 Methods and tools to promote creativity**

Currently, there are different methodologies to stimulate creativity through the generation of new ideas, the authors (Harrington et.al. 2000) in his work on Tools of Creativity and how to stimulate it in individuals and organizations, distinguish several styles of creativity:

A. Structured creativity, which is defined as detailed, complex, tool-intensive, tightly controlled, requiring little facilitation and effective for individuals or groups.

B. The non-linear one, which predominates as open thinking and which releases human energy. They describe it as exciting, unpredictable, fast-paced, focused on quantity rather than quality, encouraging people's involvement and normally used in groups.

C. Provoked creativity, which resorts to any catalyst (analogy, metaphor, random words, etc.) to generate mental activity. The authors describe it as easy to build and start, provides a lever to move forward, requires active facilitation, and is easily employed by individuals or groups. Many of the practices of Edwar de Bono's thought are classified in this type of provoked creativity practices, which we will be able to observe later on in figure X

D. The creativity marked by the "aha" or "eureka", Greek exclamations that appear when a great idea is found. This appears suddenly and that has contributed to the most important discoveries. According to the authors, their experience has shown that this style of creativity

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produces less than 1% of all creative ideas and is described as step-less, pattern-less, issue-centered, a process that employs simple and individually intensive methods.

In this study we have collected some of the most important tools to promote creativity created by different authors, among them we can highlight:

#### *Brainstorming*

This is a tool to put into practice in a group, created by (Osborn, 1954) , whose purpose is to generate as many ideas as possible about a particular problem or situation in a relaxed work environment. This tool of exchanging ideas has been proven to be very effective. Osborn concluded that a group of people working together develop more and better creative ideas, as long as they are based on a series of rules and norms of respect and, above all, avoiding conflict.

In his case, Osborn avoided the closure of his agency thanks in part to the tool he created. This technique of creative thinking seems to have been in use since 1919. Years later, the term Brainstorming was included in Webster`s International Dictionary, which defines it as: "The practice of a conference technique in which a group of people seeks the solution to a specific problem, gathering all the ideas contributed spontaneously by its members".

#### *Random words or free association*

This tool was designed or invented by the sociologists (Kent and Rozanoff, 1910), who came up with many words that were related to the production of creative motivation. This technique consists of incorporating all kinds of ideas by forging a relationship between a randomly searched term and the problem in question that we want to solve. Let's take an example in which unemployment is defined as the main problem, trying to counteract it with entrepreneurship. Two commonly used examples are the lack of positive, constructive and creative business thinking for the sector, and the minimal use of business management techniques and principles.

Once the main problem has been established, in addition to some practices, a word is chosen at random, either by picking a page number from an encyclopedia or from a dictionary. Once the word has been chosen, the aim is to find all kinds of connections between the word and the problem to be solved, until an optimum solution is found.



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*Thinking and saying*

This tool belongs to a type of structured creativity, it is a simple form of analysis of other ideas that facilitates the understanding of many more people. It is normally used in groups and consists of raising a main business idea and, next, three columns are drawn on a sheet of paper. In the first of these, a member of the group expresses his or her idea or solution to the problem in a non-specific way, so that it can be understood by any member of the group; in the next column, the name of the person who has written this idea, which we have just mentioned, is notified; and finally, another member of the group receives this same sheet of paper, tries to identify the solution provided by his or her partner in column one, and finally, writes down what he or she thinks at that very moment, in order to help solve the problem by providing some new concepts or rectifying that of his or her partner.

It is an appropriate technique to measure people's creative potential and ability to concentrate on or understand what is being said or explained.

*Lateral thinking*

Method developed by Edward De Bono (De Bono, 1992) which was exposed in his Manual of Creativity, where we can find many of the practices of the present time as for the promotion of the creativity. These practices can be seen next in the Picture 1. According to De Bono, in this method information is used not as an end but as a means, and it is the basis of creativity. Lateral thinking encourages the emergence of new ideas for the logical elaboration of thought. Figuratively, as De Bono (1993, p.3) says, "vertical thinking gives more depth to a hole already started; the side starts a new hole".

If we look for a more concrete definition of lateral thinking in this author's Manual of Creativity, we find that this is a creative thinking that is basically a different way of thinking without using logic, although this may seem irrational. The author himself affirms that logical thinking has only one direction, it follows the path that he himself traces, while lateral thinking has a multitude of ways to come to a solution through different paths from those of logical thinking. On the other hand, he also states that both types of thinking are equally necessary; lateral, creative thinking is for creating ideas, and logical thinking is for developing these same ideas.

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Picture 1: Some Methods of Lateral Thinking (Edward de Bono)



*Source: Creatividad e innovación para el desarrollo empresarial (Horacio Murcia)*

### **2.3 Innovation**

Returning to the study of ( Ordoñez, 2010 ) we can understand that the clearest contribution of innovation to an organization, is that it can allow us to create competitive advantages, with the possibility of creating a differentiated product and going one step ahead of the competition. The growing importance of innovation is a fact today with the existence of such competitive markets where customers are increasingly sophisticated, segmented and exclusive. But turning innovation into a reality is not easy, if we investigate, this same difficulty has its origin in a contradiction, since people want innovation, but at the same time they also continue to show resistance to this and the new processes that it entails. So in organizations and in the person itself, there are contradictory attitudes acting, some as brakes for innovation and others as accelerators.

In order to enhance these accelerators and try to reduce the effect of standstill by some elements of the enterprise, it is important to understand the political map of the company and to anticipate the internal and external consequences of the new changes brought about by these innovations. We cannot forget that not every change is positive for an organization, the irruption of any change can lead to internal power conflicts and small cold wars among departments. Therefore, it will be necessary to test the innovation itself, the newness must be kept in perfect alignment with the strategic direction of the company. It will be necessary

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to analyse its compatibility with the business and to do so in a comprehensive manner, ranging from external aspects, such as consumption patterns or distribution networks in the same market, to more internal aspects, such as the financial capacity of the company, commercial development or brand image.

As we can see, the implementation of innovation cannot be left to chance, since many factors have to be taken into account for it to be successfully implemented in an organization.

#### 2.3.1 Concept

The Oslo Manual is a guide for the measurement and study of scientific and technological activities that defines concepts and clarifies activities considered as innovative.

As it indicates in its introduction to the 2005 edition, the definitions contained therein can serve as a guidance for research transfer activities, given that their definitions have been adopted in Spanish legislation on incentives for innovation and are a reference for public bodies. This manual defines the main concept of innovation together with four different types of innovations which will be explained later: product, process, marketing and organization. It applies to both industry and services, including service utility companies. The Manual suggests that the usual links among business, suppliers and customers are extended in the innovation process to other relationships with research centres, higher education and public and private development agencies.

As we can see in the 2005 edition of The Oslo Manual (OCDE), "An innovation is either the implementation of a new or significantly improved product (good or service), or process, or a new business method or a new method in business practice, work organization or external relations". It also points out that "The minimum requirement to be considered an innovation is that the product, process, business method or organizational method must be new (or significantly improved) for the company. This includes products, processes and methods that companies are developing for the first time and those that are adapted from other companies or organizations.

Years later, in the 2018 edition of The Oslo Manual (OCDE), we find a similar new concept of definition: "An innovation is a new or improved product or process, or combination of both, that differs significantly from the unit's previous products or processes, and which are made available to potential users or have been put into use by the unit.

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Following with the concepts found in The Oslo Manual, we are going to define the four types of innovation according to the scope of the organization it covers:

#### **2.3.1.1 Product innovation**

Adapted from The Oslo Manual (2018, p.58) "It provides a new or significantly improved good or service in terms of technical characteristics or in terms of use or other functionalities. The improvement is achieved with knowledge or technology, with improvements in materials and components, or with integrated computing".

In order to be considered an innovation, a product must present characteristics, uses and efficiency differentiated from previous products in the company, also including improvements in terms of time or service.

#### **2.3.1.2 Process innovation**

Adapted from The Oslo Manual (2018, p.59), it is the "Concept applied to both production and distribution sectors. It is achieved by significant changes in the techniques, materials and/or software used, which are aimed at reducing unit production or distribution costs, improving quality, or producing or distributing new or significantly improved products".

New or significantly improved techniques, equipment and software used in ancillary support activities, such as purchasing, accounting or maintenance, would also be included as process innovations. The introduction of a new, or significantly improved, information and communication technology (ICT) is a process innovation if it is intended to improve the efficiency and/or quality of a core support activity.

#### **2.3.1.3 Innovation in Marketing:**

Adapted from The Oslo Manual (2018, p.60), "It consists of using a marketing method not previously used in the company that may consist of significant changes in design, packaging, positioning, promotion or pricing, always with the aim of increasing sales. Variation in the method has to be a fundamental break with what has been done before"

When we refer to changes in positioning, these include direct sales, the development of new sales channels, the creation of franchises and the sale of licenses for use, or modifications in the way the product is displayed. While when we talk about changes in promotion, these involve the modification of the communication system outside the product, using new media.

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We could also include in the changes of promotion, for example, the replacement of the company logo, loyalty systems and personalization of the customer relationship.

#### **2.3.1.4 Innovation in Organization**

Adapted from The Oslo Manual (2018, p.61), it is "Changes in business practices and procedures, changes in the workplace, in external relations as implementation of strategic decisions with the purpose of improving results by improving productivity or reducing internal transaction costs for customers and suppliers.

It is also considered an innovation in the organization, the introduction of management systems for production operations, supply and quality management, as well as the updating of knowledge management. While when we refer to the external factors of the company, we would consider innovation in the organization as any variation in the organization's relationships with customers or suppliers, including research centers and the integration of suppliers or outsourcing activities to external companies.

#### **2.3.2 Types of innovation**

It is very important to be aware of the classifications of types of innovation because it can help us to examine with a broader view the existing possibilities of an innovation itself and the difficulties that a company may encounter when applying such innovation in its business. We can't treat all innovations the same, because different types require different knowledge and will have different impacts on competitors and customers in an industry.

Currently, we can classify innovations according to four aspects: their degree of novelty, according to the relationships among the components that make up a product, Competency Enhancing Innovation versus Competency-Destructive Innovation, and, finally, according to whether it is a disruptive innovation and sustaining innovation or supporting innovation.

##### **2.3.2.1 Innovations according to their degree of novelty**

According to the degree of novelty of the innovations we will classify them in :

*Radical or major innovation:* this innovation involves a sudden breakthrough, whether caused by the emergence of a new product or process. The relevant variable of this innovation is that it produces significant improvements in the results, leaving aside the improvement in the costs it entails. In most cases this innovation requires new

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manufacturing techniques and organizational changes, often representing a technological discontinuity.

*Incremental or gradual innovation (Kaizen)* : It consists of focusing efforts on the improvements of the products or processes already known. It is the one that takes place continuously in any industry, most of the time as a result of learning by doing. While radical innovation is focused on product or process improvements, incremental innovation aims at cost reduction.

**2.3.2.2 Innovation according to the relationships among the components that make up a product:**

According to (Henderson and Clark, 1990), in this classification of innovations we can distinguish between:

*Modular innovation*: represents a substantial change in the design of a component in a product or system, but the new component design fits comfortably into the previous product configuration. The same relationship structure is maintained.

*Architectural innovation*: the components are essentially the same but their technical interrelationship shows a greater sophistication. Its configuration is modified.

Picture 2: From the high wheel bike to the safety bike



Source: Subject "Innovation management in the enterprise"

In picture 2, we can see an example of architectural innovation since the components of the two bicycles are the same, only the size of the wheels and some other details differ. Their technical interrelationship offers a greater degree of sophistication, since in the so-called safety bicycle ( on the right in the image ), the posture was much closer to the ground, the wheels were almost the same size and the pedals, connected to a cogwheel through gears and a transmission chain, moved the wheel from behind. Another technical improvement

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was the air chamber whose inner tube is filled with air cushioning part of the knocking against the roads.

#### 2.3.2.3 Competence-enhancing innovation versus competence-destroying innovation

This differentiation is one of the easiest to recognize. The Competency-Destructive Innovation is built on the knowledge and skills that a product that we have already developed has been offering to us, such as the evolution of a product like the Iphone as we can see in the picture 3. The Competency-Destructive Innovation is totally the opposite, without adding any improvement to the new product or even making obsolete the skills of the previous product, it is a fairly radical change of a product that tries to cover the same needs, a clear example may be the transition from typewriters to the first computers.

Picture 3: Evolution of the iphone mobile phones



Source: [www.webadictos.com](http://www.webadictos.com)

#### 2.3.2.4 Disruptive innovation and sustaining or supporting innovation

Disruptive Innovations: Based on completely new features of a product technology, this new technology can mean something different for the product, such as lower cost or greater ease of use. These types of innovations are extremely revolutionary and discontinuous compared to their predecessors and subject clients and consumers to adopting new references or patterns while discarding existing ones.

Supporting (or sustaining) innovations: These innovations are based on the trajectory of a product or technology, trying to improve its performance, offering demanding customers a better operation. As we have mentioned, they are characterized by the continuous

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improvement of the operation of a product or process and are mostly adopted by companies already established in the industry. They are usually based on existing performance dimensions.

#### 2.3.3 The importance of innovation and its systematization for a company

Innovation stands out as a very important capability for companies today, so much that it has been positioned as the most important motor for transformation and growth. In the time frame in which we find ourselves right now, with a world that is so globalized and where competitiveness among companies is increasingly greater, it becomes more important that companies are continually innovating or improving their products or services, in order to maintain that competitiveness in a progressively saturated market in which consumers are increasingly demanding to move away from monotonous products.

Some more specific concepts that can try to answer questions such as Why is innovation increasingly important? or Why does the company have to be constantly innovating? are, among others, the following: *Technology is changing rapidly*, and as we mentioned before we are in a globalized world where everything is constantly developing, also the technologies that can be part of an innovation, because of this, the increase of new competitors with new products is increasing; *Decrease of the product life cycle*, the product life cycle is decreasing by leaps and bounds, from 12 to 4 months for software, from 24 to 12 months for computers and consumer electronics, and from 36 to 18 months for large appliances; *Customers are becoming more sophisticated and segmented*, these customers are increasingly demanding and expect improvements in terms of novelty, quality, price, and another segment such as product exclusivity. Another concept in response to the above questions would be the rapid creation and change of markets.

In conclusion, with markets and technology changing at the rapid pace we have been discussing, there is continuous pressure to come up with new and better products, services and processes more quickly, without wasting the opportunity for a competitor to get ahead of you.

On the other hand, this conclusion makes us see the importance for companies to systematize innovation, ensuring a regular flow of innovations, being aware in advance that not all of them will have a successful future due to the risk and uncertainty that are always related to an innovation.



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As we said, many innovative ideas do not necessarily will turn into successful new products. A term which will help us understand this last statement is The Innovation Funnel. According to Camps (2011, p.1), "This term refers to the process that goes from the identification of opportunities to innovate, to the launch of those products or services to the market, which have been overcoming all the filters that we have established to advance through the different phases".

The metaphor of the funnel is used in this case as a simile, since on its wider side we introduce a multitude of ideas of which only some will manage to come out on the opposite narrower side and end up going the long way that differentiates an idea from a reality. In picture 4 we can see the idea of the funnel itself captured in an image. There is no single prototype model, as it can have as many phases as we consider. At the end of each phase, we reach a point when we have to decide whether the idea continues to move towards later phases or is rejected, basing this decision on a series of criteria that will have been previously established. Typically, a funnel will contain the following phases with some possible variations: opportunity identification, idea generation, pre-development, development, testing and launch.

Picture 4: The innovation funnel



Source: *Blog de Innovación :The Jazz Musician (Xavier Camps)*

One of the companies that puts the systematization of innovation into practice the most is 3M (Minnesota Mining and Manufacturing). 3M is a company that essentially deals with surface coating and many of its innovations are variations of sandpaper and abrasives, adhesive tape, or computer storage media. 3M has been perfectly established in its market

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for years, these are usually mature and their technologies are basic is why they have chosen the strategy that tries to have 50% of their business come from products invented during the last three years, thus manufacturing 60000 different products.

Picture 5: 3M's company logo( Minnesota Mining and Manufacturing )



Source: [www.3m.es.com](http://www.3m.es.com)

#### 2.3.4 Phases of innovation

Innovations always involve a certain level of uncertainty, risk and complexity. These factors make it quite important to develop a structure, and a methodology for the development of new products or technologies, including a practical process of innovation structured in different phases with the aim of leading the project towards a goal in a focused way.

According to (Hengsberguer, 2019) an innovation process can be divided into 4 phases, each having its own characteristics, with the initial phases being more creative and less structured and the last more focused on the process.

##### *1st Phase: The idea*

Any innovation process must begin with the tracking and discovery of innovative potential and the derivation of ideas that are subsequently evaluated. When we speak of innovative potential we refer to an unresolved customer need, a new technical solution to a problem, a new possible market, or a problem with the customer.

There are different options to identify such innovation potentials. There are essentially two different approaches: the Specific Search, which as Hengsberger,(2019, p.2) indicates we

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refer to as "The search for potential is based on the innovation strategy and the derived search fields"; and, the Random Search, which according to Hengsberger,(2019, p.2) in this

"One encounters random potential discovery impulses. For example, a new technology is found in searches. However, employees can also generate impulses through the company's suggestion or based on customer feedback".

#### *2nd Phase: The concept*

A particular idea with goals and expectations arises from phase 1, and it is in this second phase when an intensive analysis is carried out with the intention of gathering more and more precise information on aspects such as market and customer needs, market potential, the company's possibility of gaining a competitive advantage over other companies in the sector, the risks and viability of innovation, and the legal conditions established, such as laws, standards, patents, etc

Another important aspect to be analysed is that of the client's needs: identifying needs, both objective and unconscious or unsatisfied, client problems without current solution, real importance of their needs, etc. All this requires a systematic professional approach, through interviews with customers, focus groups, workshops of leading users or customer observations.

On the basis of these analyses, the first concepts for a solution are developed.

#### *3rd Phase : Solution.*

The objective is to develop a ready-to-use solution that can be launched on the market. Prototypes are built and tested, both in the laboratory and in the market under real conditions.

Once the solution has reached maturity, it will be released for implementation and marketing in the form of technical specifications and know-how for application and production.

#### *4th Phase : Market*

Bringing the product to the customers requires the physical availability of the product, which in turn, requires procurement, production and logistics based on defined concepts.

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From there, all marketing and sales channels are activated. On the basis of continuous evaluation and analysis of the product on the market, e.g. through customer feedback or quantitative market analyses, measures are taken to increase sales, margins and customer satisfaction, among other tools, the famous 4P marketing tools are used. All these activities can be summarised as innovation marketing.

#### **2.4 The relationship between change, creativity and innovation**

Previously, we have defined the terms change, creativity and innovation separately, but these concepts also need to be understood as a whole, since they are the ones that integrally form a process which makes companies different from their rivals, something very valuable nowadays in such a competitive environment. Because of the need to adapt to this globalized world in which everything goes so fast, changes in companies arise, and these changes are the triggers of the process mentioned above.

Once we have assumed that the company has to undergo different changes to adapt to new technologies and the competitive environment, we have to find the driving force of these changes through the development of new ideas or what we call creativity. According to (Montes, 2012) creativity would be the starting point of the process we are mentioning, being the raw material in terms of achieving new ideas.

The difference with the next step of the process, which would be innovation, is that creativity formulates new ideas to drive change, while innovation is already the phase when we try to define and implement these ideas for the creation of new products, services or technologies that can provide us with a competitive advantage over our competitors.

We must always bear in mind that this process needs to be developed in a healthy environment, with support from the organisation's top management, hence the increasingly important figure of the innovative entrepreneur.

In order to understand in a better way the relationship between these concepts and as a conclusion of this section, we will use the following quote from the author Montes, ( 2012, p.1) "Creativity and innovation are different tools, but they work together to result in the generation of those changes within the organization that lead to greater customer satisfaction. For this reason, it is important that companies seek a creative and innovative

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management philosophy that allows them to develop both vertically and horizontally, achieving a highly competitive and differentiating value chain".

**3. CERAMIC INDUSTRY**

From this part of the work on, we will be aware of the importance of having knowledge about the concepts defined above, change, creativity, and innovation, as they have very high involvement in this ceramic sector. In this next section of the paper we will present the situation of the ceramic industry, its products and we will analyze a company belonging to the sector.

**3.1 Global situation of the ceramic sector**

To have a global vision of the ceramic sector, and how it has evolved in recent years, we are going to compare figures of the sector in years 2015 and 2018.

As indicated in its study on the ceramic sector ( Veral, 2016 ), based on the Acimac study, the volumes of world production and consumption of ceramics remained fairly stable in 2015 compared to previous years, specifically with a production in this year of 12,355 million square metres, with production growing in all regions except Asia, where it was stagnant. In the following chart 4 we can see how the world production of ceramic tiles is distributed by world areas.

Chart 4 : Main production areas of ceramics 2015

Áreas	2015 (millones m2)	% de prod. mundial	% variación 15/14
Unión Europea (28)	1.218	9,9	2,2
Resto de Europa (Turquía incluida)	572	4,6	0,4
América del Norte (Méjico incluido)	327	2,6	6,2
América central y del sur	1.193	9,7	-0,1
Asia	8.627	69,8	-0,9
África	413	3,3	3,0
Oceanía	5	0,0	0,0
Total	12.355	100,0	-0,1

Source: [www.vigilancer.es](http://www.vigilancer.es) (Sabrina Veral, 2016)

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As we can see in chart 4, Asia concentrates almost 70% of the world production, followed by the European Union with 9.9%, and this followed by Central and South America with 9.7% of world production.

As far as exports are concerned, worldwide exports have also increased with respect to the previous year (2014), going from 2,685 to 2,735 million square metres, with the greatest increase in the European Union. This increase was caused mainly by Spanish exports, which have driven the recovery of the Spanish sector. Observing the data in the following chart 5, we can draw the following conclusions: Asia continues to be the leading country in exports (as in the case of production seen above) with 55.4% of world exports, followed by the European Union with 31.3%; as we can see, the difference between these two ceramic areas is much smaller in terms of exports than the difference in production (70% for Asia, 10% for the European Union). This being due to the fact that Asia is the largest consumer of ceramic tiles in the world, reaching 8166 million m<sup>2</sup>, with 67.1% of local consumption, which indicates that most of its production is for domestic sale, hence its worldwide proportion of export figures is not as overwhelming as that of production.

On the other hand, the European Union is a region that exports much more tiles, hence its higher percentage of exports with respect to production.

Chart 5 : Main export areas of ceramics 2015

Áreas	2015 (millones m2)	% de las exportaciones mundiales	% variación 15/14
Unión Europea (28)	856	31,3	4,5
Resto de <del>europa</del> (Turquía incluida)	139	5,1	-7,3
América del Norte (Méjico incluido)	65	2,4	-1,5
América central y del sur	126	4,6	5,0
Asia	1.514	55,4	1,3
África	35	1,3	-22,2
Oceanía	0	0,0	
Total	2.735	100,0	1,5

Source: [www.vigilancer.es](http://www.vigilancer.es) (Sabrina Veral, 2016)

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Next, we will analyze these same previous global data of the sector in the year 2018, considering the ceramic study ( Lazarus , 2019 ), being able to identify the differences that arose in the sector between the period 2015-2018.

In 2018, it was the first time that in the last years the production and the world-wide consumption of ceramics diminished, the fall was of a 3.6 % with respect to the previous year. Even with all this, world production reached 13099 million square metres, exceeding the production figure for 2015, which suggests that the trend in ceramic tile production has been upwards until 2018.

This decrease in world production is due, among other factors, to the 5.2% reduction in the previous year of the leader in production, which, as in 2015, continues to be the Asian region. This decrease has also caused, as we can see in chart 6, that the difference between Asia and its chaser, the European Union, has started to decrease slightly in favour of the latter, with respect to the data we obtained in 2015. It is also worth highlighting the decrease in the region of Central and South America, going from 9.7% in 2015 to 8.1% of world production in 2018, and the great irruption of the African market going from 3.3% to 5.5% of world production, being the region that has grown the most with respect to the previous year.

Chart 6: Main production areas of ceramics 2018

	<b>2018</b> Millones m <sup>2</sup>	% de prod. mundial	% var. 18/17
Unión Europea (28)	1.366	10,4%	0,3%
Resto de Europa*	618	4,7%	0,5%
América del Norte **	348	2,7%	-3,9%
América Central y del Sur	1.064	8,1%	-0,9%
Asia	8.980	68,6%	-5,2%
África	718	5,5%	3,2%
Oceanía	5	0,0%	0%
<b>TOTAL</b>	<b>13.099</b>	<b>100%</b>	<b>-3,6%</b>

\*Incluyendo Turquía.  
\*\*Incluyendo México.

Source: [www.vigilancer.es](http://www.vigilancer.es) ( Lazarus , 2019 )



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As far as exports are concerned, the continued decline in the European Union's global export figure compared to Asia's is noteworthy. As it was already the case in 2015, Asia continues to be the world leader in ceramic exports with 51.8% of world exports, but it is still far from its overwhelming dominance as far as ceramic production is concerned, since it is which consumes its own production.

As we have mentioned, the European Union continues its escalation with exports getting closer and closer to the Asian continent, going from 31.3% to 33.4% of world exports, thus establishing itself as one of the most exporting areas of ceramics on the planet.

Observing chart 7, we should not let go past the great reduction of exports experienced by North America with a negative rate of 12.5% with respect to the previous year, which accumulated to that of the previous year with 6.7%. This reduction in exports may be related to the arrival of Donald Trump to power (2017) and his more protectionist policies and confrontation with other world economic powers.

Chart 7 : Main export areas of ceramics 2015

	<b>2018</b> Millones m2	% de las exportaciones mundiales	% var. 18/17
Unión Europea (28)	917	33,4%	0,4%
Resto de Europa*	174	6,3%	5,5%
América del Norte **	49	1,8%	-12,5%
América Central y del Sur	146	5,3%	5,8%
Asia	1.425	51,8%	-1,2%
África	38	1,4%	2,7%
Oceanía	-	0,0%	
<b>TOTAL</b>	<b>2.749</b>	<b>100%</b>	<b>- 0,1%</b>

\*Incluyendo Turquía.  
\*\*Incluyendo México.

Source: [www.vigilancer.es](http://www.vigilancer.es) ( Lazarus , 2019 )

After making this comparison of world production and exports for years 2015 and 2018, we can better understand the global situation of the ceramic industry in recent years. As we have seen, there is a leading area in the ceramic sector which is Asia, quite different from the second power which is the European Union, and in third place at a short distance from the latter we find Central and Latin America. Although in terms of exports this big difference between Asia and the European Union is quite reduced by the fact that Asia also continues



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to be the world's biggest consumer of ceramics, therefore, much of the ceramics they produce do not leave their borders, while the European Union is a much more exporting region. In fact, its two main producers, which are Spain and Italy, are not among the countries that consume the most ceramics.

Continuing with the ceramic study (Lazaro, 2019) for a more exhaustive analysis of year 2018, we find the following relevant data regarding the world ceramic sector.

Analysing by countries which the tile producing powers are, we can see in chart 8 that China is the leading ceramic producing country, representing 43 % of the world production. But in 2018 it had a large contraction with a negative variation rate of 11.2 % due to factors such as the increase in the cost of materials and greater competitiveness on the world market.

The other two dominant powers in ceramic production are India and Brazil. Spain, of which we will speak at length later on about its situation in the international tile market, occupies the fifth place, with a production figure slightly higher than Italy, the other European power. Another fact that should be highlighted as regards the production of countries is that the sum of the production of the first ten powers accounts for 80.7% of the total world production, which indicates that the tile sector is fairly centralised.

Chart 8: TOP 10 ceramic producing countries

	<b>2018</b> Millones m2	% de producción mundiales	% var. 18/17
China	5.683	43,4%	-11,2%
India	1.145	8,7%	6,0%
Brasil	793	6,1%	0,4%
Vietnam	602	4,6%	7,5%
España	530	4,0%	0,0%
Italia	416	3,2%	-1,7%
Indonesia	383	2,9%	24,8%
Irán	383	2,9%	2,7%
Turquía	335	2,6%	-5,6%
Egipto	300	2,3%	0
<b>TOTAL TOP 10</b>	<b>10.570</b>	<b>80,7%</b>	<b>-4,9%</b>
<b>TOTAL MUNDIAL</b>	<b>13.099</b>	<b>100%</b>	<b>-3,6%</b>

Source: [www.vigilancer.es](http://www.vigilancer.es) (Lazarus, 2019)

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As we see in chart 9, the positions change quite a bit when we talk about world exports by country. China is still the leader with a lower figure than its production, with 31.1% of the world exports, but the second and third positions are no longer occupied by Brazil and India, but only by the European tile powers, Spain and Italy. Spain stands out in second place worldwide with 15.1% of total world exports. As it was the case with tile production, the 10 main exporting countries also account for 86.5% of world exports.

Chart 9: TOP 10 ceramic exporting countries

	2018 Millones m <sup>2</sup>	% producción nacional 2018	% export mundiales 2018	% var. 18/17	Valor 2018
China	854	15,0%	31,1%	-5,9%	3.759
España	414	78,1%	15,1%	1,7%	2.729
Italia	328	78,8%	11,9%	-3,0%	4.547
India	274	23,9%	10,0%	20,2%	859
Irán	151	39,4%	5,5%	2,0%	361
Brasil	100	12,6%	3,6%	11,2%	398
Turquía	100	29,9%	3,6%	7,8%	506
México	46	17,8%	1,7%	-13,2%	237
Polonia	43	28,7%	1,6%	-4,4%	265
Emiratos Árabes Unidos	42	60,9%	1,5%	-8,7%	171
<b>TOTAL TOP 10</b>	<b>2.352</b>	<b>22,6%</b>	<b>85,6%</b>	<b>-0,2%</b>	
<b>TOTAL MUNDIAL</b>	<b>2.749</b>	<b>21,0%</b>	<b>100,0%</b>	<b>-0,1%</b>	

Source: [www.vigilancer.es](http://www.vigilancer.es) ( Lazarus , 2019 )

Finally we will make an analysis of the average price per square meter in each country, as we can see in chart 10, with which we can make an estimation of the value and quality of the production of tiles in each country.

Chart 10: Average prices per m<sup>2</sup> of ceramics

	2015 €/m <sup>2</sup>	2016 €/m <sup>2</sup>	2017 €/m <sup>2</sup>	2018 €/m <sup>2</sup>
China	-	4,9	4,5	4,4
España	6,5	6,5	6,6	6,6
Italia	13,7	13,8	13,9	13,9
India	4,1	3,2	3,2	3,1
Irán	3,4	2,6	-	2,4
Brasil	3,4	3,1	3,3	4,0
Turquía	5,9	5,7	5,2	5,1
México	5,2	5,2	4,6	5,2
Polonia	5,3	5,3	5,6	6,2
Emiratos Árabes Unidos	5,5	5,8	4,0	4,1

Source: [www.vigilancer.es](http://www.vigilancer.es) ( Lazarus , 2019 )

### **Case study: Strucker Porcelanico S.L.**

Looking at the above-mentioned producing powers, which were India, Brazil and China, we can see that of these powers India and Brazil have the lowest prices on the international market, although the latter has had an upward evolution in price in 2018. The Chinese ceramic superpower, on the other hand, has higher prices than the other two but the evolution it has followed has been totally the opposite of Brazil, as it has suffered a decrease in its prices until it has sold the square metre of tiles at 4.4 Euros by 2018.

On the other hand, the main European ceramic producers, Italy and Spain, have established themselves in a higher price range, especially and quite prominently Italy, which in 2018 sold the square metre of ceramic at almost 14 Euros. With these data we can understand that, generally, the European ceramic is seen in the international market as a ceramic of better quality and more exclusive than the Asian giant and Brazil's, which follow a different strategy focusing on price and not on the quality of the product.

## **3.2 Spanish ceramic industry**

### **3.2.1 History of Spanish ceramics.**

As the Spanish Association of Manufacturers of Ceramic Tiles and Flooring (ASCER, 2020) tells us, it is difficult to date the first samples of ceramics applied to architecture. We have evidence of the use of tiles by the Egyptians more than 4,600 years ago.

The islamization of the Iberian Peninsula was the entrance door of the glazed ceramics in Europe. In Andalucia, in the 13th century, ceramic pavements with a great variety of tones were used, replacing coloured marble. The glazed clay was developed in our country in the thirteenth and fourteenth centuries, being the Mudejar Art of the city of Teruel and the Alhambra in Granada good evidence of this.

The pressure of the Christians in the 15th century made the centre of production of ceramics with metallic reflections move from Malaga to Manises, and this ceramic art flourished between the 14th and 15th centuries in the Valencian Community. From there, it was exported to Venice, Egypt, Syria and Turkey, being Italy the most important customer (Manises became a supplier of the Papacy during the 15th century).

It was in the 16th century, from Italy, when its travelling ceramists expanded the new technical findings (polychromy) and the ornamental repertoires of the Renaissance. This

**Case study: Strucker Porcelanico S.L.**

caused the collapse of the medieval tiles of Manises, generally produced in blue monochrome. With masters from Andalusia or Talavera, the pieces ended up being made in the city of Valencia. This is how the Baroque, Rococo and Classicist tiling of Valencia was born, which lasted until the middle of the 19th century. At the beginning of the 20th century, Valencian production was centred in Manises and Onda, which had training centres from 1916 and 1925, respectively.

Finally, the arrival of gas to the tile factories in 1981 meant one of the most important technological changes in the sector. With the use of gas, cleaner combustion gases were obtained, which allowed direct contact of the gas with the product to be fired.

We have to add to this the new systems for transporting the material in the kiln. All these changes were key to improve quality, reduce firing times, save energy and increase production. Larger formats were introduced, the first cogeneration plants were born and the glaze industry achieved great relevance worldwide.

The "cluster" became established and achieved spectacular growth, becoming the first European and second world producer, leading, together with Italy, the design, quality and trade of ceramic tiles.

Nowadays, in the MUSEO DEL AZULEJO "Manolo Safont" ( Onda , Castellón ), there are still outstanding ceramic collections, from the classical period to the present day. (Picture 6)

Picture 6: Museu del Taulell "Manolo Safont"



*Source: Own elaboration*

**Case study: Strucker Porcelanico S.L.**

**3.2.2 Situation of the Spanish ceramic sector in the international market.**

According to the official data on the Spanish ceramic sector in 2018/19 presented in the study (VIGILANCER, 2020), we are going to know the situation of our country with respect to the world market of tiles.

As we have already discussed in the previous section, in recent years Spain has become established as a great exporting power, being in 2018 the second exporting country in the world with more than 15% of the world exports, with 414 million square meters and a growth of 1.7% with respect to the previous year and accumulated to the growth of the previous years, since the Spanish exports have followed an ascending dynamic.

On the other hand, as far as production is concerned, Spain is the fifth world producer, only surpassed by China, India, Brazil and Vietnam, which are countries that produce in large quantities without taking into account the quality of the product.

As we can see in chart 11, for the coming years, the Spanish ceramic sector shows a downward trend in production but an upward one in sales. To be more specific, Spanish sales increased in 2019 compared to 2018 by 4%, reaching a figure of 3740 million Euros, and production decreased by 5% compared to the previous year, going from 530 to 503 million square metres.

An important fact is that exports accounted for approximately 75% of the total Spanish sales in 2019, reaching a figure of around 2,800 million euros, increasing by 3% with respect to 2018. Domestic sales also increased by 8% and could reach a turnover of 940 million euros in 2019.

Chart 11: Spanish ceramic tile industry

	2018	2019*	% var. 19/18
<b>Producción</b> (millones m2)	530	503	-5%
<b>Ventas Totales</b> (millones €)	3.597	3.740	4%
<b>Exportación</b> (millones €)	2.727	2.800	3%
<b>Ventas Nacionales</b> (millones €)	870	940	8%

Source: [www.vigilancer.es](http://www.vigilancer.es) ( *International Press Conference Tile of Spain- ASCER, 2020*)

**Case study: Strucker Porcelanico S.L.**

But, how are Spanish tile exports distributed worldwide? Historically, and this has been the case in recent years, Europe is the main market for the Spanish ceramic sector, with more than 50% of our exports going to Europe.

In 2019, following a very similar trend to previous years, the main destination of the Spanish ceramic industry was France with an export figure of 302 million Euros, followed in second place by the USA with 278 million Euros. In recent years, especially in 2019, there was a great deal of tile sales, with a positive evolution of 16.9% in 2019 compared to 2018. Exports to Morocco, the neighbouring African country, are also growing by leaps and bounds, with almost the same growth rates as in the USA, reaching a turnover of 93 million euros per year.

As mentioned above, in chart 12 we can see that of the 10 main countries to which Spanish production is assigned, 5 of these are France, the United Kingdom, Italy, Germany and Portugal, all belonging to the European Union (except for the United Kingdom).

Chart 12: TOP 10 target countries

	<b>2019</b> Millones €	% var. 19/18
Francia	302,4	7,9%
EE.UU.	278,8	16,9%
Reino Unido	169,1	6,7%
Italia	104,2	3,0%
Alemania	95,7	-2,3%
Marruecos	93,0	15,5%
Israel	84,0	-7,7%
Arabia Saudí	69,7	-15,0%
Federación Rusa	66,3	-4,2%
Portugal	64,3	11,3%

\*Datos de enero a noviembre de 2019

Source: [www.vigilancer.es](http://www.vigilancer.es) ( *International Press Conference Tile of Spain- ASCER, 2020*)

### Case study: Strucker Porcelanico S.L.

## 3.2.3 Cluster in the Spanish ceramic sector

### 3.2.3.1 Theoretical concept

The concept of "Cluster" was popularized by Michel Porter, (1993, p.73) in his book *The Competitive Advantage of Nations*, referring to "a geographically proximate group of interconnected companies and associated institutions, in a particular field, linked by common and complementary characteristics, including companies of final products or services, suppliers, financial institutions and companies of related industries", and adds that "the competitiveness of a region is based on the competitiveness of its industries which in turn is improved if an industry is immersed in a deep network".

Based on the study of the theoretical concept (ACTUALIDAD EMPRESA, 2004), we understand that clusters also serve to increase competition, collaboration and informal links among companies and institutions. They generally bring together a wide range of industries and other entities such as suppliers, distribution channels, customers, manufacturers of complementary products and companies from industries related to the activities to which the sector itself is dedicated to. These are concentrations of companies specialised in the same sector, whose interrelationship dynamics justifies the increase in productivity and efficiency, the reduction of transaction costs and the acceleration of learning, as well as the dissemination of knowledge.

As we have previously mentioned, a cluster is not only composed of companies from the same industrial area, it is necessary to include higher and technical education institutions, suppliers and associations, with the government playing a fundamental role by assuming the leadership for the attraction of new organizations and the growth of existing ones.

### 3.2.3.2 The ceramic tile cluster in Castellón

According to the study (IVEX, 2011), in Spain, the ceramic activity is strongly concentrated in the Valencian Community, specifically in the province of Castellón, either in terms of the number of companies, workers or operating income. Production has doubled in the last ten years, and is mainly assigned for exports (approximately 55%), in particular to the United States, Saudi Arabia, France and Great Britain.



### Case study: Strucker Porcelanico S.L.

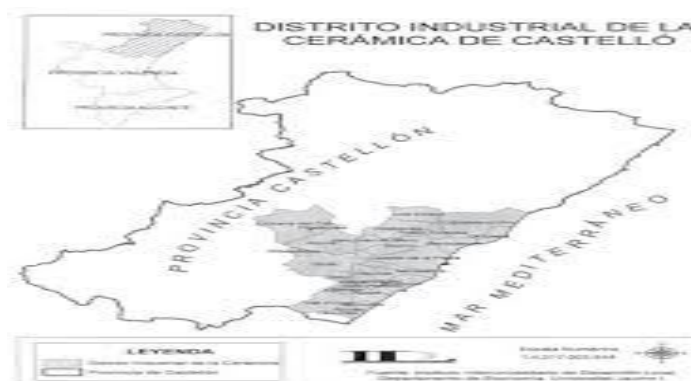
Castellón concentrates 94.5% of national production. Furthermore, in the economy of the Valencian Community, the ceramic sector occupies a prominent position, representing a little more than a fourteenth part of both the operating income and the industrial employees of the Community.

Based on the study of the ceramic cluster of the province of Castellón, ( Hervás et al. 2015), the Castellón cluster is formed by four localities: Alcora, Onda, Villareal and Castellón de la Plana, being this last one the capital of the province of Castellón (Picture 7). All of them belong to the region of "La Plana". This cluster includes all the activities of the value chain of the tile industry, as well as several public R&D organizations, such as the Institute of Ceramic Technology (ITC), educational centers, such as Jaume I University, the closest university to the Cluster, and private institutions, such as trade associations, for example Ascer, Anffecc, and Asebec.

According to (Ascer, 2010) ,this cluster provided about 20000 direct jobs in 2010 and currently it is estimated that there are about 300 people related to the industry.

Returning to the previously mentioned study ( Hervás et al. 2015), within the cluster, the most important auxiliary industries are frits and glazes. Castellon glaze industry is the world leader with nearly 26 companies, with a high volume of exports reaching 66% of the total production, valued at 900 million euros. As our most direct competitor, Italy, the ceramic industry in Spain has a concentration coefficient of 420% above the average (in the area of Castellón).

Picture 7: Castellon ceramics industrial district



Source: *El distrito industrial de la cerámica* ( Fuertes et al. 2005)



**Case study: Strucker Porcelanico S.L.**

### **3.2.4 Innovation and trends in the Spanish ceramic sector**

As he tells us ( Gabaldón and Fernández, 2011 ), the Spanish ceramic sector, more specifically the industrial district of Castellón, is characterized by a high level of dynamism based on technological innovation, both of the product and of the process, the origin of which lies in its suppliers, the mechanical equipment industry, the glazes and ceramic colours industry and the frits industry. Globalisation implies new behaviours and one of the most important is the increase of cooperation between the actors of the innovation system. That is why the Spanish ceramic sector needs to be at the forefront of innovations in order not to lose its position in the market against the most direct competitors.

In terms of innovation, the Spanish Association of Ceramic Tile Manufacturers has insisted on the commitment to R&D in the sector, as it is aware of the importance it can have for the growth of this sector in the near future. The Spanish sector is currently considered a world leader in terms of technological development, design and product and service quality.

Moreover, compared to other sectors of the Spanish economy, the ceramic sector is the one that provides more investment in R&D, either from the private sector companies themselves or through institutions such as the Instituto Tecnológico de la Cerámica (ITC) or ASCER among others.

According to the portal dedicated to technology (Cámara de Valencia), these are some of the main applications of technology to the ceramic sector:

- Research into ceramic materials for architecture and the home.
- Technological solutions to make the ceramic sector more sustainable and increase energy efficiency
- Technology for thermal energy efficiency and reduction of CO<sub>2</sub> emissions
- Make use of cogeneration for greater efficiency in obtaining electricity.
- Technology for the reduction of environmental pollution.
- Savings in possible losses in the transport and transformation of the product.

Speaking of trends, it is true that the Spanish ceramic sector is one of the world leaders in innovation and quality, but there is always a continuous need to incorporate new techniques and product improvements through new technologies. The report "Lines of innovation for the

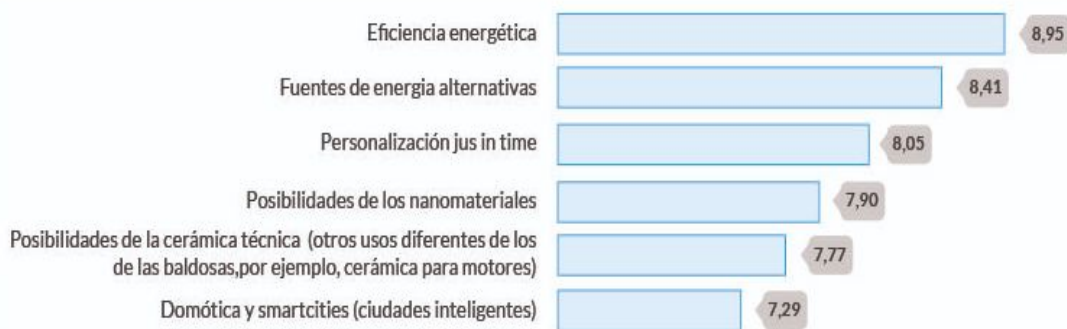
**Case study: Struker Porcelanico S.L.**

ceramic sector" (ASCER, 2013) shows us the main trends of the sector regarding the product and in the service.

As for the sector trends regarding the product we can find: design applied to ceramic products (such as 3D design or virtual reality); 3D manufacturing and printing; alliances with other sectors, mainly specialized in industrial technology to apply all the possible knowledge to their products; the use of alternative energy sources building a more sustainable sector with the use of green energies that allow a more environmentally friendly production; new ceramic technologies for domestic homes or Smart Cities; and, finally, the use of nanomaterials in the sector.

This study mentioned above carried out by (ASCER, 2013) also includes the assessment of several ceramic entrepreneurs about issues related to technology in the future development of the ceramic sector. The scale used was from 1 to 10 as shown in table X. We can see that energy efficiency and alternative energy sources are going to be one of the main trends in these years in the ceramic industry.

Chart 13: Assessment on the main trends in these years in the ceramic industry.



Source: Lines of innovation for the ceramic sector (ASCER and ITC)

On the other hand, with respect to the trends of the sector referring to the service, the following are found: express distribution to increase customer satisfaction, reduction of stock and increase of the use of intelligent logistics, digital catalogues and apps for mobile devices and, finally, online store and social networks since in the last years the distributors have increased exponentially the number of online stores and their presence in social networks for a more direct contact with the client in particular.

**Case study: Strucker Porcelanico S.L.**

**3.3 The product**

**3.3.1 Ceramic characteristics.**

Ceramics is a sustainable material by its nature and its production process. The raw materials it is made of come from the earth (clay), and form a natural and high-quality product when added to water and the firing process. Some of the most important characteristics that we can highlight after consulting the website of (CERAMICA DE ESPAÑA, 2020) are the following;

**SUSTAINABILITY** : as we have commented in the previous introduction, its raw materials come from the earth ( the clay ) , together with the water and the fire. These three elements have been linked to the development of man since the beginning of time.

**QUALITY**: The investment in I+D+I of the ceramic industry in the last years has obtained products of high technological rigor and great quality.

**CLEANING AND HYGIENE**: Ceramics are characterized by their high ease of cleaning and disinfection, both with water and with disinfectant products. In addition, its capacity as an electrical insulator prevents the capture of electrically active environmental dust, contributing to well-being.

**ANTIALLERGIC**: The inert nature of ceramics and its impermeability prevents humidity, avoiding the development of germs and fungi.

**REQUIRES MINIMAL MAINTENANCE**, except for normal cleaning operations.

**RESISTANCE AND DURABILITY**: Ceramics present great resistance to sudden changes in temperature, humidity, chemical and biological agents, as well as hardness and resistance to friction. This guarantees its great durability in buildings, encouraging its proliferation in places such as facades, public spaces, etc.

**TRANSITABILITY**: Thanks to the efforts in innovation, the ceramic pavements have reached some technical properties that make them the ideal material for areas with high traffic, exposed to low temperatures, or subjected to dirt or strong blows. They are known as "high traffic floors", and can be seen in buildings and large constructions.

### **Case study: Strucker Porcelanico S.L.**

**SUSTAINABLE:** Besides being a resistant material which stands the test of life (it can reach very sustainable life cycles), the industry is betting on the recyclability of the material. In addition, its use in facades (ventilated facades) and roofs achieves significant energy savings.

**ANTI-SKID:** The ceramic pavements, without altering its aesthetic aspect, obtain this benefit modifying its superficial finish.

**IGNIFUGE:** Ceramics don't burn or melt, therefore, they don't release harmful substances, neither for the man nor the environment.

**VERSATILITY:** Ceramics are versatile and adaptable to any surface. The different possibilities of placement, its textures and volumes, allow to design the spaces freely. Ceramics can be used in any space: interior or exterior, walls, floors, facades, furniture, etc.

**WARMNESS:** The combinations of ceramics with leather or fabrics, multiply the possibilities of creating warm environments. It is also an ideal material for installing underfloor heating.

**LUMINOSITY:** The brightness and the use of the ceramic pieces allow playing with the light to create effects of depth, amplitude and movement, bringing life to the created space.

### **3.3.2 Tile typology**

Continuing with the previous portal (CERAMICA DE ESPAÑA), we know that ceramic tiles are made of clays and other inorganic raw materials, which are ground and/or kneaded, moulded into thin slabs, and then dried and fired at a sufficient temperature to acquire the required properties in a stable manner.

The ceramic tiles can be unglazed (UGL) or glazed (GL). The unglazed tiles are fired once, while the glazed tiles are glazed between the first and second firing (double firing) or before a single firing (single firing). There are no standardised or generally accepted definitions or denominations of the different types of ceramic tiles, so when using the denominations, it may be necessary to make the appropriate clarifications.

**Case study: Strucker Porcelanico S.L.**

**3.3.3 Manufacturing process**

Following the information collected in the portal mentioned in the two previous sections, the manufacturing process of a ceramic product begins with the **selection of the raw materials**: clays, feldspars, sands, carbonates and kaolins. Since they are usually used as they are extracted from the mines or quarries, the most important thing is to ensure their prior homogenisation.

For this purpose, they are subject to a **milling process** that disperses the particles and reduces them. This process can be carried out in a dry or wet way. Wet milling is the most common and the resulting suspension is called slurry, in which the clays are slid into a ball mill and diluted in water.

For the subsequent compacting and drying processes, the water content must be reduced by drying, by **atomisation**. The slurry is pumped, pulverised and dried by bringing it into contact with a stream of hot gases inside an atomiser. These gases come from a conventional air-gas burner, or the exhaust gases from a cogeneration turbine are used, which reduces the energy cost of the drying process.

Picture 8: Spraying machine in a ceramic company



*Source: [www.icf-welko.it/](http://www.icf-welko.it/)*

From this process, an atomized powder is obtained, formed by spherical granules, hollow inside and very uniform, so the powder is very fluid. This facilitates the filling of the moulds

### Case study: Strucker Porcelanico S.L.

and the **pressing**. The most common procedure for shaping the parts is dry pressing, using hydraulic presses (picture 9), with a high compacting force, which manage to reduce the humidity of the parts to 5-7 %.

Picture 9: Ceramic press



Source: [www.sacmi.com](http://www.sacmi.com)

This excess water would generate the fragmentation of the pieces, so they must undergo a **drying stage**, until a humidity of between 0.2 and 0.5% is achieved. In this way, the firing process and, where appropriate, the **glazing process**, are carried out properly. In the case of unglazed products, the drying stage is followed by the firing stage.

If they are glazed, the piece is then covered with one or more layers of glaze. Among these processes the most usual are : in curtain, by spraying, dry, or the decorations. The treatment with enamel gives the piece the technical and aesthetic properties required and named above.

**The firing** of ceramic products is one of the most important stages in the manufacturing process, since during it a series of reactions that change the microstructure of the piece take place, giving it the desired final properties.

In the firing stage, the thermal cycle is considered in terms of temperature and time, and the atmosphere of the kiln, depending on each composition and the ceramic product to be obtained. Nowadays, fast firing predominates, which is carried out in single-layer roller kilns. In this type of kiln, the pieces move over the rollers and the heat is provided by natural gas-air burners located on the kiln walls, transmitting this heat by convection and radiation



### Case study: Struker Porcelanico S.L.

mechanisms. This type of oven, of which we can see a prototype in picture 10, has made it possible to reduce the duration of the cooking cycle extraordinarily, to less than 40 minutes.

Picture 10: Ceramic ovens



Source: [www.sacmi.com](http://www.sacmi.com)

To guarantee the optimal quality of the process, there is one last stage: **the identification of the defective parts**. This verification process, which used to be manual, is now automated, using recognition software with pre-established parameters, which allow the separation of irregular parts or those with colour defects, for example. With the **packing stage**, the ceramic tile manufacturing process ends.

### **3.4 The company : STRUKER PORCELANICO S.L.**

In order to see a practical case on all the concepts that we have been developing in this particular work, as well as the analysis of the ceramic sector and the importance of innovation in this sector, we are going to carry out an analysis of the company established in the Castellón Cluster of Porcelain Tiles. We will also explain the application to the company of its recent innovation and the performance it has brought to the company.

Struker is a small family-run company currently located in the town of Onda (Castellon), specializing in the manufacture, distribution and sale of porcelain stoneware, ensuring that their products are marketed in over 75 countries, spread over the five continents.

The company has 29 employees, thanks to which they produce 180,000 m<sup>2</sup> of rectified tiles, while thanks to their other forte, the sale of shower trays, they have established an annual sale of around 5,000 units, valued at 1,450,000 euros.

**Case study: Struker Porcelanico S.L.**

**3.4.1 History and characteristics of the company**

As one of its two CEOs explains to me in an interview, the company was founded by his father under the name of Ceramica Bou & Gali S L, more than 35 years ago in Almazora and later the factory was passed on to his sons, the current CEOs of the company. Struker has always been an innovative company, based on continuous improvement to provide its customers with products that are always up to date.

Due to the good operation of the company, in 2011 Struker moved its headquarters to Onda (picture 11 and picture 12 ) to try to take advantage of the benefits of being integrated in a Cluster, and on the other hand, it extended its range of products with the production of bathroom articles, wash basins, baths, made of stone resin with full body that combines the advantages of natural stone with resin, as well as accessories and bathroom furniture and the new division Struker Bathis was founded.

Today Struker continues to strive to be at the forefront of innovation at all times, managing to be a company that makes the difference with its competitors. A good example of this is the application of Inkjet printing for shower trays, which we will explain below.

Picture 11: Struker facilities in Onda



Source: [www.strukerporcelanicosl.com](http://www.strukerporcelanicosl.com)

Picture 12: Struker facilities in Onda



Source: [www.strukerporcelanicosl.com](http://www.strukerporcelanicosl.com)

Once we know the roots of the company, we will know a little bit about the **mission and business vision** for which they want to be recognized by their customers.

The mission of this company is to offer innovative solutions for the home and bathroom, with the aim of satisfying all the needs and requirements of its customers, offering products of



**Case study: Struker Porcelanico S.L.**

medium-high quality and with a high aesthetic value, establishing a close relationship with customers, all at a reasonable price.

While the company's vision is to continue being a company with a markedly innovative character as they have demonstrated up to now, focusing mainly on offering the greatest number of solutions to customers as we can see in pictures 13 and 14, adapting products and processes to their needs, in order to maintain a higher position with respect to its most direct competitors.

Picture 13: Adapting products to each customer's needs



*Source: [www.strukerporcelanicosl.com](http://www.strukerporcelanicosl.com)*

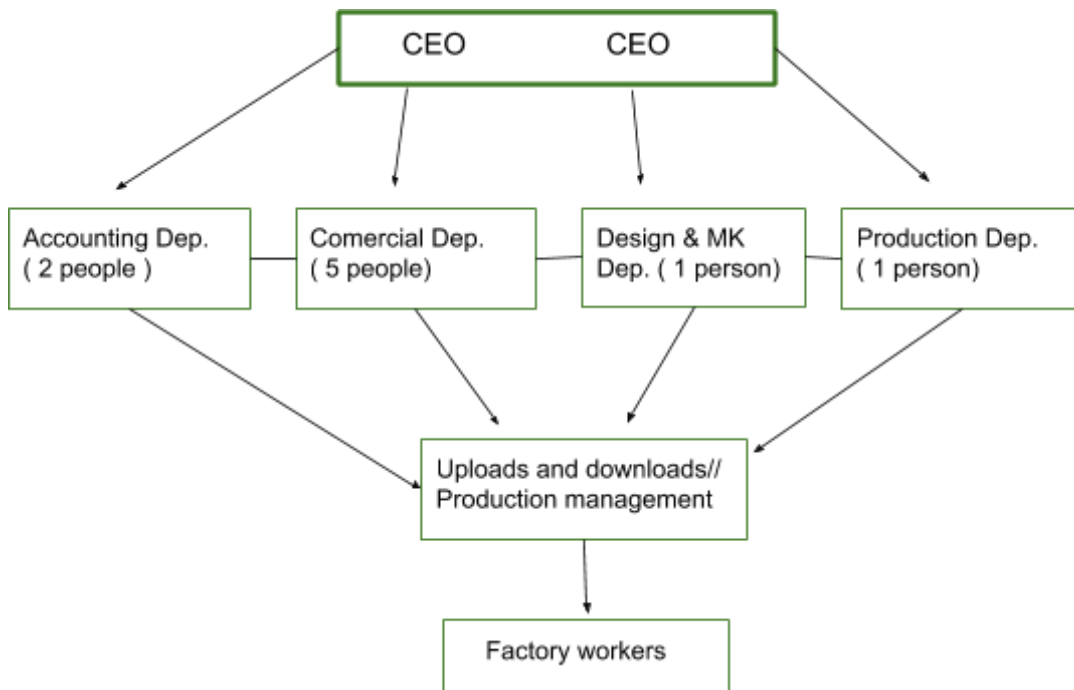
As for the **company's structure**, it follows a departmentalization by functions, since it is one of the most effective structures for small companies and with a fairly standardized product. It is divided into functional areas, and groups together people who have a similar position within the company or who specialise in similar functions. The organization chart of this type of structure usually shows the parts that make up an organization and the relationships that link them.

As we can see in graph 1, Struker's structure is formed starting from the top, by the two current directors of the company; a step below, the company is structured by functional departments. It only has the four departments that we can observe since we are not talking about a large company, and many of the functions of a company that do not appear in the organization chart, such as human resources or cost accounting, have to be performed either by senior management or those staff who are assigned the task. Finally, Struker has

**Case study: Struker Porcelanico S.L.**

another department at a lower level in the hierarchy that serves as a link between all the above-mentioned departments and the factory workers, taking care of order and production management. All departments are perfectly interrelated and there is direct and two-way communication that works well.

**Graph 1: Organisational Structure Struker**



*Source: Interview with Struker's CEO*

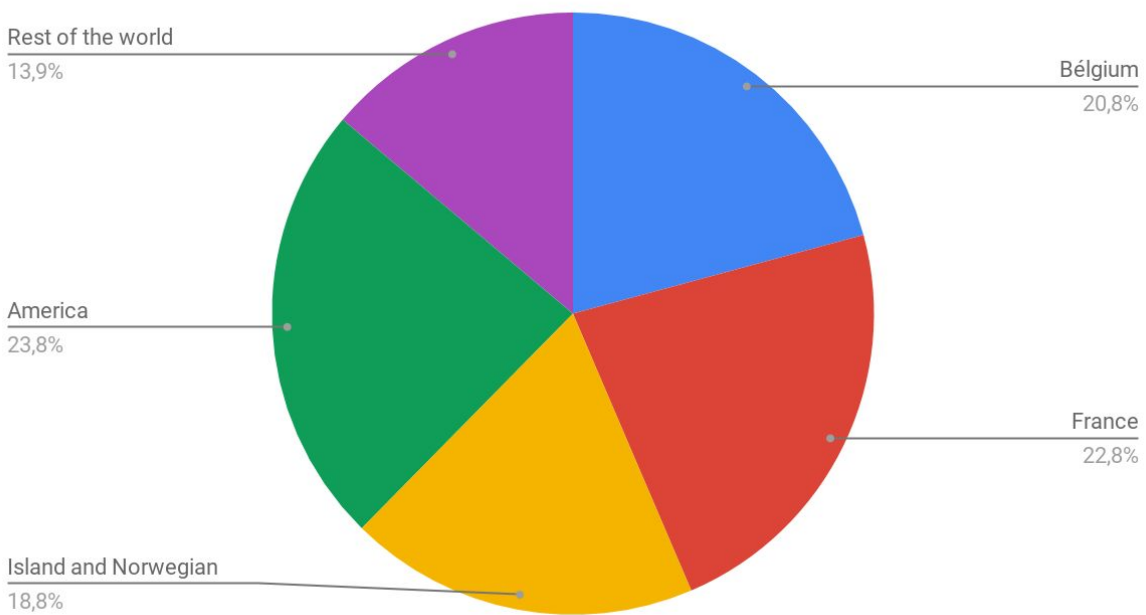
With regard to the **distribution channels**, Struker has three types of channels to reach its customers. The first is the company's own sales staff (belonging to the sales department mentioned above), distributed by geographical area, who are responsible for communicating all the company's news to its customer base in that area, or to agents established there. The second way would be the cooperation of the company with external agents, who have created their own portfolio of clients in areas where the company is not used to marketing. These agents charge a sales commission previously agreed with the company. Finally, we find the wholesalers. The company makes an agreement with wholesalers so that part of their production can be sent to their warehouses and reach the end customer. At present Struker cooperates with the German giant Bauhaus and Leroy Merlin.

**Case study: Struker Porcelanico S.L.**

Focusing on the distribution of Struker's **exports**, in graph 2 we can see how sales are quite centralized in two geographical areas, mainly in Europe where France and Belgium add up to around 45% of total exports, due to the large portfolio of clients of our sales representatives in these two countries. On the other hand, it is also worth noting Iceland and Norway, with almost 19% of total exports, thanks to the links of the Bauhaus stores in these two countries. In short, almost 60% of Struker's production remains in Europe. On the other hand, the USA and South America (America in the graph) account for 24% of exports, and only 13.9% applies to other different countries distributed around the world.

**Graph 2: Percentage of foreign sales 2019**

**Percentage of foreign sales 2019**



*Source: Interview with Struker's CEO*

Finally, we will focus on the brand's **positioning** in the market and on its most direct competitors. As we have been saying before, the Struker brand is established in the market in a medium-high quality range as far as its products and services are concerned, trying to establish affordable prices for the consumer but providing them with that asset to position themselves ahead of their competitors. Therefore, with everything we have been quoting

**Case study: Struker Porcelanico S.L.**

about this small innovative company, it lets us see that it uses a commercial strategy of differentiation, with the aim of developing an action plan to achieve that the product or service is positioned in the market and stands out from the competition, to achieve attention, recognition and, if possible, customer loyalty generating a competitive advantage. One of the main tools used by the company to establish this differentiation is the high degree of innovation of its products, and its high quality in customer service.

These advantages are intended to position Struker ahead of its most **direct competitors** in the market, namely B10 and SW Shower.

Picture 14: Baños 10 logo



Source: [www.b10bath.com](http://www.b10bath.com)

Picture 15: SW Shower



Source: [www.showersw.com](http://www.showersw.com)

As it indicates us in its web page (Baños 10, 2020) B10 was born at the beginning of the 90s, and accumulates more than 2 decades of experience in the manufacture of hydromassage bathtubs, plates and columns of shower. They are present in more than 20 countries, with export sales representing a high percentage of the company's total turnover.

B10 is also located in Onda and specializes in the design and meticulous production of baths, with the best raw materials, the best technology and the most modern production systems, having 6 different hydromassage systems. The company's constant concern is the quality and safety of its products.

### Case study: Struker Porcelanico S.L.

On the other hand, on the SW Shower website (SW Shower, 2020) we find that this company began its journey in the decade of 2000-2010, founded with a spirit of effort and sacrifice to grow the business.

Located in the town of La Vall d'Uixó, the knowledge about a new material, polyurethanes, and their interest in innovation encourage them to apply this material of great versatility and good performance in relation to water, dressing it with an appearance similar to wood.

Subsequently, textures became the soul of the company and the protagonist of all the products that SW Shower makes.

#### 3.4.2 SWOT analysis of the company

To conclude the summary of this company belonging to the Castellon Cluster, we are going to analyse it more personally, trying to identify its internal strengths and weaknesses, and external threats and opportunities to which this small company in the ceramic sector is subject.

##### **Weaknesses:**

*Production limitations:* Being a small company, it cannot carry out the same amount of production as other larger companies in the same sector, which makes it impossible to achieve economies of scale in order to lower prices and face up to large companies.

*Storage space limitations / Limited stock:* As it does not have a very large space to store material, the company has to make most of its orders to order, taking considerably longer to deliver the product to the customer than if the product were in stock.

*Low online presence:* Until now Struker has had little presence on digital platforms, both on its website and on social networks, with a rather low percentage of online sales.

*Competition:* Belonging to an industrial cluster means being continuously in a fight to beat your most direct competitors, because there are many companies nearby that are engaged in the same activity.

*Technological restrictions:* The implementation of technological innovations has a very high implementation cost in companies, so small companies like this one often present economic difficulties to establish these improvements.

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**Strengths:**

*More than 30 years of experience:* Struker has more than 30 years of experience in the ceramic sector, following the evolution of this sector very closely during all this time, having a wide portfolio of suppliers and clients established in the market.

*Product diversification:* As we have commented during the description of the company, Struker does not focus on a single product, as it offers the grinding of ceramic tiles, as well as its part dedicated to the bathroom, with the production of worktops and shower trays accompanied by the marketing of furniture for this purpose.

*Constant expansion of the product range:* We have also previously mentioned the innovative spirit of this company, which is constantly developing products to satisfy all types of needs of its customers, expanding increasingly its range of products.

*Innovation in exclusive products:* One of the hallmarks of the company is the ability to offer unique products in the market, obtaining a great competitive advantage over its competitors.

*Ability to work for other factories in the sector:* Thanks to the above strength, Struker has the ability to produce for the competition, since thanks to its innovations, it offers a unique product in the market. This gives you the opportunity to control the prices of that product on the market.

*Location of the company in the neuralgic center of the Spanish ceramics:* As we had mentioned in the weaknesses, belonging to a Cluster we can take it as a weakness due to the high existing competitive level, or as a strength at the moment of the existing proximity with suppliers or logistic centres, with the possibility of establishing direct relation with these, among other of the advantages of being a part of an industrial Cluster.

**Threats:**

*Current unstable economy / Uncertainty environment :* The current economy is faced with a high degree of uncertainty. We find ourselves with a cyclical economy in which recession and expansion stages are continuously occurring, hitting the ceramic sector hard.

*Limitation of risks to clients by the insurance companies :* These recessionary stages mentioned above make the credibility of the companies to the insurance companies

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decrease when making payments. Due to this, the insurance companies offer a lower risk to these companies, which makes the purchase of big quantities of these impossible.

*Italian brands are considered the best in design and quality:* Although data from recent years show that Spanish production exceeds that of Italy, historically it has always been considered worldwide that the quality and design of Italian products are superior to those of the Spanish sector.

*Great link to the construction sector:* The ceramic sector is highly dependent on the construction sector, a negative factor since depending largely on a single sector can be very detrimental.

#### ***Opportunities:***

*Access to expanding markets:* We can take advantage of this opportunity through strategies such as presence in international ceramic fairs, to establish links with agents and customers in expanding markets.

*Second market after Italy:* The Spanish market is considered the second most important in the world in terms of quality and design behind the Italian market, which serves as a great showcase for Spanish companies in the sector at an international level.

*Continuous innovation:* Struker's continuous innovation process can be an opportunity to continue creating new exclusive products in a mature market where innovation is difficult.

*Great importance of exports:* A large part of the company's sales are abroad, thus helping to diversify the market.

## **4. INNOVATION: DIGITAL PRINTING (INKJET) APPLIED TO CERAMICS**

### **4.1 Definition of the INKJET technique**

As it is offered by the portal (Atria Innovation, 2018), Inkjet technology is about combining electronic signals with mechanical and chemical engineering. This technology consists of the formation of an image from the controlled deposition of drops, which join together and form this image on the substrate itself.

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Thanks to the continuous advances in algorithms of controllers and softwares and a greater knowledge of fluid mechanics, Inkjet technology is one of the main technologies for decoration in many sectors, such as the ceramic sector.

This technology offers several competitive advantages over previous technologies such as tampography or screen printing. Among these advantages, we highlight:

*Environmental progress* : This is one of the main changes compared to previous technologies. The sustainable principles of Inkjet lie exclusively in the reduced use of inks when projecting the design, since a wide variety of colours can be achieved without having to prepare each one separately. In this area, we consume less raw material and reduce the use of water and electricity.

*Versatility*: With the previous techniques, to print an image we used some masks which must be changed whenever we were going to print different images. Nowadays with Inkjet printing, you just have to load the image you want to print in the Software.

*Flexibility*: Inkjet technology allows printing on elements of complex geometry, without the need of contact between that element and the print head. Moreover, thanks to the digitalization of the process, this technology offers great production flexibility, achieving a great decrease in the cycle time of each print in comparison to previous techniques.

*Savings*: In addition to the savings mentioned in the environmental advance mentioned above, such as energy and material savings, maintenance stages are excluded compared to previous technologies, such as the possible post-printing cleaning stage.

#### **4.2 Inkjet technology applied to the ceramic sector**

As mentioned in the previous section, Inkjet is an innovative digital printing technology because of the infinite finishes and creative possibilities it offers, as well as the high environmental efficiency it brings.

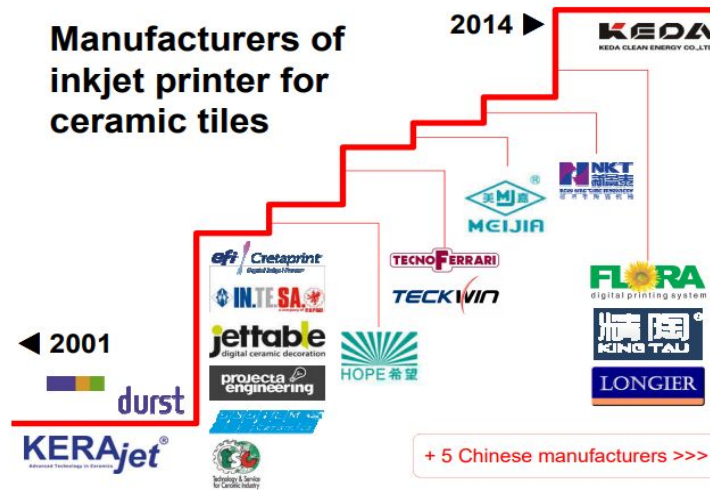
According to the ceramic company's website (Decocer, 2018) this set of features belonging to this technology has been transferred together with a strong R&D component to the ceramic sector, through the digital Inkjet Ceramic printer, which injects the ink with impeccable accuracy, drawings and textures on ceramic surfaces, even allowing the reproduction of reliefs without the need to invest in moulds.



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Since 2000, when the first Inkjet printer for industrial ceramics was launched by the company Kerajet, as we can see in picture 16, this technology has revolutionised the traditional production system of ceramic decoration worldwide, and continues to amaze with advances that take digital printing on ceramics to the highest level.

Picture 16: Manufacturers of inkjet printer for ceramic tiles



Source: *Impresión digital de la baldosa cerámica (Gadini y Dondi, 2018)*

Some of these advances are for example HD technology, high definition which implies greater realism and precision in digital printing, and the improvement of both its software, which is in charge of digital printing, and hardware (heads and inks) to improve the speed and data management when printing surfaces such as ceramics.

As we have mentioned before, Kerajet is the world pioneer in digital ceramic printing, and currently has the most advanced and versatile digital ceramic printing machines on the market, offering an efficient and competent production process. That is why we are going to make a brief explanation of the composition and operation of its digital printer for ceramic products.

Extracting information from the company settled in Castellón (Kerajet, 2020), the Kerajet printer (picture 17), has a compact and robust design that makes it a perfect machine to be part of a production line where thanks to its advanced electronics and innovative and intuitive software make it the most versatile and complete printer in terms of features in the world market.

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Picture 17: Kerajet ceramic printer



*Source: [www.kerajet.com](http://www.kerajet.com)*

It is made up of a multi-head technology that allows the configuration of the modules in up to 12 freely configurable printing bars, perfectly synchronized applications in the production line of glues, enamels, lustres, metallic inks, matte gloss effects and even grains, being able to expel ink at very high levels of speed and precision.

Other of the main characteristics of the Kerajet printer are the following:

*It offers two types of movement:* The Rigid Bench, designed for rapid prototyping and high production, and on the other hand the Web, designed for long production runs and for implementation in line.

*High number of inks:* Possibility of using up to 12 inks configured in 24 printing units with resolutions that reach up to 1200 dpi in 8 freely configurable grayscale levels.

*Modular system, removable modules:* As mentioned above, this system has up to 12 print bars and removable modules for greater accessibility and functionality.

*Active ink circulation system:* This system guarantees maximum stability in printing, with an individual input and output sensor for each ink, individual temperature control and a quick ink change system.

*Own management software:* The software developed by Kerajet allows the user to obtain the maximum performance of the equipment in a short time. It allows the user to manage, load and view the designs before printing, as well as to select the printing units in use and to

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define the working mode: piece by piece, roller or paneled canvas among the most important functions. Another of its strengths is that it can manage up to four productions at a time, making it unnecessary to stop the production in operation to load a new production or make any kind of correction.

#### **4.3 Incorporation of Ceramic Inkjet Technology into Struker.**

As we have been mentioning in the previous sections, the pioneer company in adopting the innovation consisting of digital printing on ceramics was Kerajet in 2000. Struker adopted this innovation once it had been perfectly established in the ceramic market and with a remarkable success in its result.

But Struker became a world pioneer when it adopted this innovation in early 2019 and added unique value by adapting digital printing to its shower trays. As we have mentioned throughout the work, Struker is characterized by a strong innovative character, achieving in the end to be the first company that offers a digital print on its shower trays, reaching through the differentiation strategy a unique competitive advantage over its rivals, besides having the ability to produce this exclusive good for them.

The adaptation of this technology to the company, and therefore to the printing on shower trays was very expensive and gradual, due to the great changes that had to be made with respect to the digital printing on normal ceramics.

The project started in February 2019 with the purchase of a KERAjet printer, like the one we have analyzed above. The first phase lasted from February to March 2019, in this phase the mechanical part and the software of the machine were adapted to the shower trays. Later, the second phase lasted from March 2019 to July 2019, when they tried to adapt the raw materials of the printing with the help of other multinationals, as they differed quite a lot from the normal ceramic digital printing technology. Finally, after many tests, the new technology was put into operation in mid-July 2019, offering the customer a differentiated product of high quality.

Due to the short time that the innovation has been implemented in the company we have not been able to obtain exact data on the benefit that Struker has been able to obtain from this new technology. Nevertheless, in an interview with one of its CEOs, he assures that the

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sales of shower trays have increased substantially with respect to when they did not have this technology.

## **5. CONCLUSION**

### **5.1 Theoretical concepts**

Throughout this project, we have described theoretical concepts, such as change and creativity, related to one of the main terms of the work, which is Innovation. We have then explained the important relationship among these, forming a joint process which companies need to adopt in order to achieve a competitive advantage over their competitors in the market. We can understand this process, starting from the fact that companies need to generate ideas (Creation), and then give shape to these concepts (Innovation), to drive a change in the company.

Regarding the main term, Innovation, we can consider it as one of the most important concepts in the business world at this moment, since as we have been commenting throughout the work, it can make a difference of the company with respect to the competition, which we can translate into greater benefits.

### **5.2 Ceramic sector**

As we have been explaining in our work, the ceramic sector is one of the most competitive in the world, since it is a product that is not very different from one company to another. Although it is true that depending on the raw materials and the production processes, the products will be of greater or lesser quality, and sometimes they will have the value of exclusivity, as in our case with the technological innovation adopted by Strucker. With all this we can conclude that currently the differentiation of the products consists in the price, quality and design, hence the importance, as we have previously mentioned, of having a high level of innovation so that there is a difference in such a competitive market.

As far as the Spanish ceramic sector is concerned, this country is a major world power in the ceramic sector, being one of the largest producers and exporters of ceramics in the world, recognised for its high quality and design. The Spanish market is characterized by a high

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centralization of this industry in the area of Castellón, formed mainly by SMEs. These companies are not generally able to develop innovations by themselves due to the low budget they have, so cooperation among them becomes vital. It is associations such as the Spanish Association of Ceramic Tile Manufacturers (ASCER) that make joint development of innovation possible.

Even though the Spanish sector is made up of small companies, many of them are generally marked by a strong innovative character. The Spanish sector is at the forefront of ceramic innovation, resulting in worldwide recognition of quality and design.

#### **5.3 The company and the innovation implemented**

As we have seen, Struker is a small family business, integrated in the Castellón Cluster, with a deep-rooted innovative character, which has allowed it to sell its medium-high quality products in a variety of countries around the world. Struker follows the export trend of the Spanish sector as a whole, with more than 50% of its production going outside Spanish borders, generally to European countries followed by the American continent.

With regard to innovation, digital inkjet printing for the ceramic sector was marketed 20 years ago, and the company in Castellon, Kerajet, was a pioneer in this sector. It has been remarkably successful and this success has allowed Struker to significantly increase the quality and design of Spanish tiles, as well as contributing a fundamental value such as sustainability to the industry.

Struker's adoption of innovation came in 2019, adapting digital ceramic printing to its shower trays, thus becoming the world's pioneer in digital printing of shower trays, offering an exclusive product, which has allowed it to increase its sales. Struker has let us verify that even without the resources and budget of a large company, thanks to the systematization of innovation, has managed to find a technology which has helped to create a strong competitive advantage over its rivals, positioning the company ahead of its most direct rivals.

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