



Facultad de Ciencias Jurídicas  
y Económicas · **FCJE**

# **IDENTIFICATION OF INNOVATION AGENTS IN THE TERRITORIAL AREA: CERAMIC AGREEMENT**

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# IDENTIFICATION OF INNOVATION AGENTS IN THE TERRITORIAL AREA: CERAMIC AGREEMENT

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## **Abstract**

In this work, we try to identify the most significant economic sectors in the municipalities that form the Ceramic Agreement through the diagnoses carried out by LABORA, specifically the Ceramic sector that has great value in our province and an advantage over others, the high innovative capacity. We will explain how the most important agents that make up the Regional Innovation System are related and the importance of its existence. In the end, we put forward some possible proposals to the problems that slow down the innovation process in the ceramic sector and the perspective for the future of this industry.

**JEL code:** O30, R10, R50

**Keywords:** Agreement for employment, competitiveness, Regional Innovation System (RIS), Innovation, ceramic industry

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# IDENTIFICATION OF INNOVATION AGENTS IN THE TERRITORIAL AREA: CERAMIC AGREEMENT

## 1 INTRODUCTION

In this work, we try to identify the innovation agents, that is, the public or private institutions that contribute in different ways to the technological progress of the companies that form the Agreement for the employment of the ceramic municipalities, and the relations between them. Firstly, we can define the Territorial Agreements as "a tool designed at the end of the 90s and, once its effectiveness had been tested, launched at the beginning of the 2000s by the European Commission with a clear objective: the fight against unemployment. (...), since the Territorial Employment Agreements and Agreements have proved to be a very effective formula in the field of reducing unemployment and improving the territories through the participation and cooperation of different public institutions, social agents and representatives of the business world". (PACTEM CV, 2019)

There are currently 26 Territorial Agreements in the Comunidad Valenciana: 7 in the province of Alicante, 10 in the province of Valencia and 9 in the province of Castellón.

We have chosen the Territorial Agreement for the employment of the ceramic municipalities and their area of influence in the province of Castellón, since the ceramic industry is of great importance for the economic and social development of the whole province, due to the business dimension and its productive concentration in Castellón. The advantage of this industry is its innovative capacity, which, through socio-economic relations between agents and flows of knowledge, favours regional development and the dissemination of innovation, with the aim of improving social welfare and the competitiveness of the ceramic sector, which will depend on the level of technology, the quality of the product, the human capital involved in production, etc.

According to the data published on the PACTEM CV website, the Agreement was established in 2010, in the face of an economic recovery. It is one of the oldest in the

Comunidad Valenciana, and it represents about 109,000 inhabitants and is managed by a public law entity attached to the Onda City Council and associated entities of the municipalities of Almassora (vice presidency), Burriana, Betxí, L'Alcora, Sant Joan de Moró, La Pobla Tornesa, Vilafamés and Costur, municipalities that constitute this Agreement. In addition, various associations and companies also collaborate. The proximity to the city of Castellón, where there are hospitals, public administrations, universities, large and small businesses, etc. makes relations with the aforementioned municipalities easier, that is, the geographical location of the ceramic municipalities is strategic for coordination between the different territories.

Regarding the ceramic sector and according to data from the Spanish Association of Manufacturers of Ceramic Tiles (2020), the ceramic industry is one of the most productive and innovative in our country. Approximately 94% of the production of this industry is concentrated in the province of Castellón, where 80% of the companies in the sector are located. This fact has led to the creation of complementary industries such as the frit or glaze industry around these companies. Small and medium sized companies that directly employ around 15,400 people, although in recent years large companies with more than 500 employees have been born, characterize it. Moreover, our country is the first exporter in volume in the European Union and the second in the world, behind China. However, the financial crisis of 2007 hit this sector and therefore one of the objectives of the Agreement is to provide solutions to this situation by designing strategies that will allow them to be more competitive and boost employment in this sector.

The increasingly competitive globalised world where we live has caused all sectors, including the whole of society, to have to adapt to the new socio-economic model in order to achieve a good position in the market, increasing the union between the agents, responsible for decision-making, and companies. The success of a country's economy depends on the ability of agents to cooperate and on agreements that allow new innovative knowledge to be acquired. Innovation processes have become an essential key to maintaining market share and this industry has a great innovative capacity, which, with the help of the agents involved in the Ceramic Agreement, is intended to make this industry more innovative and sustainable.

Therefore, due to the great relevance that innovation has in the current economic landscape, my Final Degree Project focuses on the identification of the actors and agents that participate in the innovation process of the sector and how they cooperate and communicate among themselves forming the Regional Innovation System.

In order to understand the strengths and weaknesses of the ceramic sector in the province and to be able to propose some solutions, we have analysed the territorial diagnosis of Castellón and then that of the Ceramic Agreement, taking into account aspects such as human resources and capital resources, social relations between institutions and companies, and innovation processes, which we can define as "the capacity to generate and incorporate knowledge into the economic and social system, in such a way as to maximise productive potentialities, and contribute to a more rational, more sustainable use of resources. Innovation, therefore, is related to greater competitiveness. And its continuous adoption allows identifying the existence of "intelligent territories" ". (Jorge Hermosilla, 2019).

Subsequently, we will draw up a map of the relations of the Regional Innovation System in which the confluences between the agents that we have considered most important and which intervene directly or indirectly in technological development are reflected, and to what extent these agents promote innovation. And thus, be able to define proposals for innovative actions that facilitate territorial development, economic and social improvements, and the competitiveness of companies in the ceramic industry, and in turn, develop the comparative advantage that this industry holds.

## 2 AVALEM TERRITORI

### 2.1 Territorial diagnosis of the functional area of Castellón

For a correct design of specific strategies for each territory, it is necessary to identify both the natural and human resources that the territory has, the economic sectors that are developed in the area, the territorial networks that operate and the innovation processes that help the development of the territory. To this end, in 2017 a territorial diagnosis was carried out, promoted by AVALEM TERRITORI, a LABORA (Servicio

Valenciano de Empleo y Formación)<sup>1</sup> initiative, in which the Universitat d' Alacant, the Universitat de Valencia and the Universitat Jaume I de Castellón have participated. 35 diagnoses of 15 functional areas were made. This is part of the information gathering phase of the Strategic Plan.

The diagnosis of the functional area of Castellón includes 70 municipalities, which have different geographical characteristics, different resources, and a different labour market. An exhaustive analysis of the territory must be made to identify the specific problems and thus be able to apply the correct active policies. This project is carried out to know the labour and socio-economic problems and to guarantee the participation of the local agents in the employment policies.

According to the diagnoses published by the agreement's consortium (2020), the Functional Area of Castellón had a population of 466,401 inhabitants in 2016 and an area of 3,269 km<sup>2</sup>. The needs are different depending on whether we are on the coast or inland.

From the territorial analysis and the ideas contained in the work of Ana María Fuertes Eugenio (2003), we get different economic elements.

Regarding the industrial sector, the chemical and oil-related industries are noteworthy, although the pioneering industry in this area is ceramics; the Ceramics Industrial District (CID) which covers 25 municipalities in the area where there is a high level of production and service activity related to the Urban Area of Castellón (U.A.C.). The ceramics sector is an economic engine of this functional area, it is the second sector that contributes most to the provincial GDP, behind the service sector, although we must highlight its innovative capacity as an advantage over the other sectors. The ceramic cluster is made up of companies from subsectors such as clay atomisers, tile manufacturers, glaze and frit producers and companies that manufacture the machinery needed for the production process. In recent years, the internationalisation of the sector has increased due to the increase in exports, which has been a key factor in the economic recovery after the 2007 crisis.

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<sup>1</sup> Valencian Service of Employment and Formation (LABORA)



**Figure 1: Evolution of the ceramic sector in recent years**

<b>Production sales of the ceramic sector in Spain</b>				
	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
<b>Production</b>	492	530	530	510
<b>National sales</b>	746	824	870	939
<b>Exports</b>	2570	2686	2727	2818
<b>Gobal sales</b>	3316	3510	3597	3757

\* Sales in millions of euros and production in millions of square meters

Source: Own elaboration, based on ASCER data (2020)

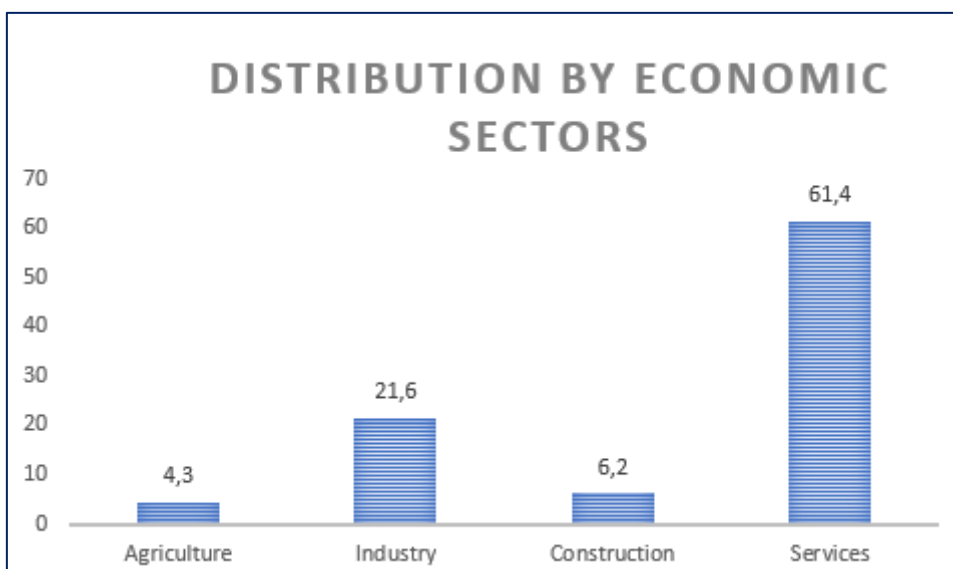
On the other hand, construction is another sub-sector with great relevance in the province, although its activity has been reduced by the real estate bubble and the subsequent financial crisis of 2007, as in the rest of Spain, but it is the sector that has had the best performance in recent years with regard to the increase in the number of affiliates. The improvement in this sector leads indirectly to the improvement of the ceramic sector; the construction of new buildings and the renovation of housing are basic for the recovery of the economy.

The service sector is the one that supports the provincial GDP and it is mostly concentrated in the U.A.C. where health services, education, shopping, and leisure centres, etc. are located. Tourism plays an important role in the north coast area, sun and beach tourism, and the relevance of music festivals such as the Arenal Sound or the FIB.

Finally, the agricultural sector is the least contributor to the economy, and is most intensified in the inland area, which is characterized by an aging population and is increasingly affected by depopulation. It is experiencing structural problems and it is in constant competition with products coming from South Africa at lower prices.

The following graph shows the percentage of the active population of the province of Castellón distributed by sectors; we see that industry is the second one that provides more work to the province.

**Figure 2: Percentage distribution of the active population by economic sector in the province of Castellón**



Source: Own elaboration, based on National Statistics Institute data INE (2020)

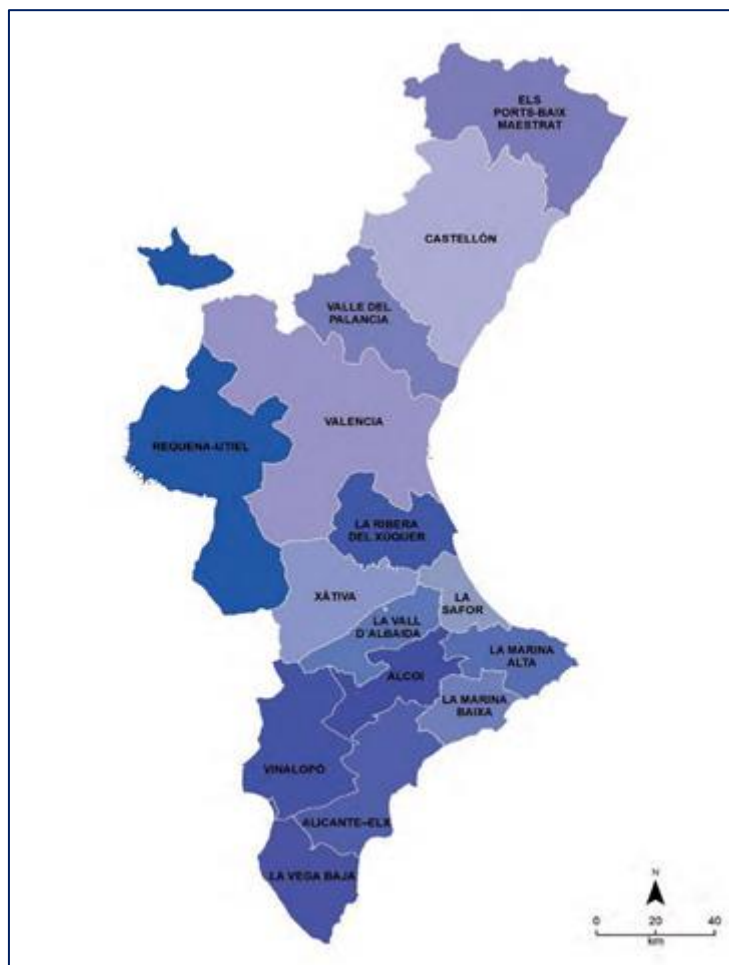
According to the ideas expressed by Alamá & Budí (2018), the elaboration of the Territorial Diagnosis has allowed the administration to know the economic, social, and labour situation of the municipalities that form the Employment Agreements. The source for obtaining information for the design and execution of the Strategic Plan has been the interviews carried out by local agents such as the local development technicians (AEDL, AFIC, social workers...), the LABORA foundation together with other labour intermediation technicians, those responsible for the Employment Agreement, trade unions, etc.

The territorial or citizen forums have been vital for the promotion of citizen participation and cohesion between institutions and citizens. Knowing the proposals for action from various agents and citizen forums has allowed us to be closer to the concerns and individual problems of the population and to be able to solve them with the design of more adapted strategies to the characteristics of each territory.

In conclusion, there is a great difference between the municipalities of the coast and the interior of the province; in fact, this is one of the most important characteristics of the functional area of Castellón. It is in the coastal municipalities where the greatest innovation processes have been applied, basically in the ceramic sector. Leaving the inland municipalities with a lack of innovation.

Although there are strategic proposals for the whole functional area of Castellón, in this panorama with very different characteristics between the territories of the province it is complex to propose the same diagnosis, therefore, an analysis of the diagnosis of each agreement will be made and more specific objectives will be defined in order to act on a more individual and correct basis in each territory.

**Figure 3: Functional areas of the Comunidad Valenciana**



Source: Territory and Employment. Castellón functional area (2018)

## 2.2 Territorial diagnosis of the Agreement for the Employment of the Ceramic Municipalities of Castellón

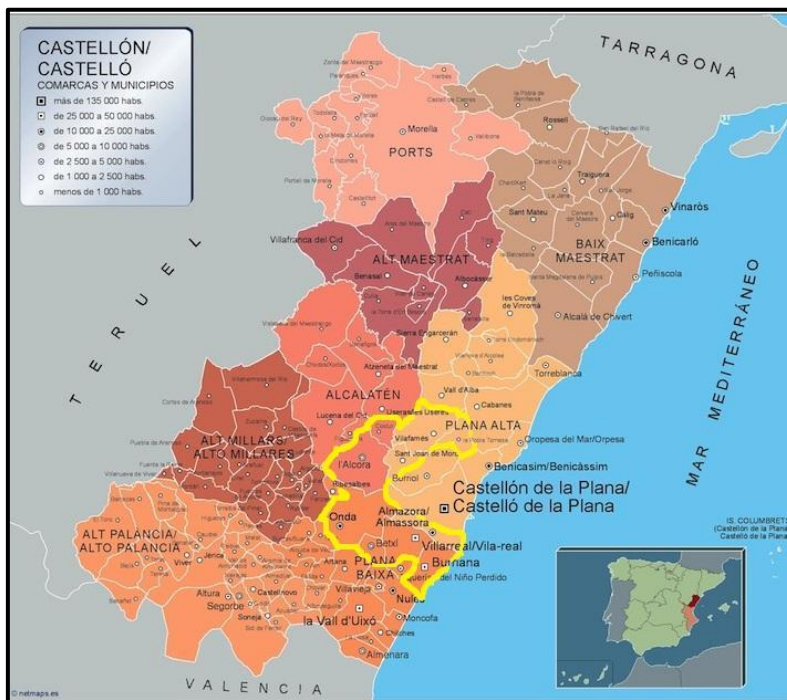
It is significant to study and analyse the diagnosis of the territory of the ceramic municipalities beforehand, in order to know the strong and weak points of the territory of the Agreement that most interests us, and thus later correctly design the strategies that manage to address the objectives agreed upon in the Strategic Plan; to achieve a more innovative and sustainable future, to increase the general economic and social welfare of the municipalities, and to achieve an increase in the competitiveness of a pioneering industry in our province, the ceramic industry.

According to the territorial diagnosis of the Agreement for the Employment of Ceramic Municipalities (2020), included 14 municipalities in 2010, when it was created: Onda, Borriana, Almassora, Vila-real<sup>2</sup>, Betxí, Pobla Tornesa, L'Alcora, Vilafamés, Sant Joan de Moró, Costur, LLucena, Figueroles, Fanzara, and Ribeslabes. Currently the last 4 municipalities mentioned (LLucena, Figueroles, Fanzara and Ribesalbes) do not belong to the Consortium of the Agreement.

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<sup>2</sup> In June 2019, the councillor of Finance of Vila-real announced that the city would leave the Agreement definitively in 2020

**Figure 4: Municipalities of the Ceramic Agreement**



Source: Own elaboration according to the territorial diagnosis of the ceramic municipalities (2020)

As we can see on the map above, the territory of the Agreement is divided between the regions of La Plana Baixa, Plana Alta and Alcalatén. Surrounding the south and west of the city of Castellón, this geographical situation makes relations between the municipalities more flexible, as Castellón is the core where the administrative and health institutions, universities, etc. are located.

Regarding the economic sectors of the municipalities of the Agreement: the ceramic sector, as we have advanced previously, is characterized by its concentration and production in the province, provides employment to a large number of inhabitants and in this territory concentrates around 90% of the ceramic production in all of Spain. We can say that the ceramic sector is a great economic engine of the territory.

Construction follows the same trend as in the functional area of Castellón; it is still a sector that has been punished due to the previous financial crisis, but with a growth trend.

In addition, agriculture, especially the cultivation and marketing of citrus fruits, plays an important role in the economy of municipalities such as Betxí and Burriana. According to data provided by the Consortium that manages the Territorial Agreement of the ceramic municipalities, the cultivation of citrus fruits occupies about 16 thousand hectares in which 6% of the population works. We must as well consider dry land crops such as almond and olive trees as an economic source for some municipalities in the interior of the province.

Regarding the tertiary sector, trade is threatened by the proximity of the large stores of the city of Castellón. On the other hand, in recent years there has been an attempt to promote tourism in the inland area, which is more intensive in the coastal municipalities, the so-called sun and beach tourism.

This territory is characterised by a fairly diversified economy since the three sectors influence the economy, but we must highlight the ceramic sector as the largest industrial and then commercial activity, and it is also the most qualified sector from the innovative point of view due to its productive concentration, its commercial competitiveness with the rest of the world and the great financial capacity of the companies that form it. Therefore, we are going to focus on getting to know the different agents that condition this industry in the innovative field.

### 3 Regional Innovation System

The objective of making the ceramic industry more productive, competitive, and innovative has created the need to establish territorial networks, i.e. relations between the different agents that contribute directly and indirectly to the innovation process. The support of institutions is an important factor for the development of innovation as it makes services and infrastructures available to companies for the improvement of these. The existence of these networks is essential if a territory is to be innovative, and socio-economic agreements and cooperation between agents promote employment and the improvement of the workers' situation.

The COTEC Foundation defines innovation as "all change (not only technological) based on knowledge (not only scientific) that generates value (not only economic)" (COTEC foundation 2016, p. 7)

The possibility of introducing innovation in the territory's companies provides them with a competitiveness to be able to enter and maintain a good position in the international market. Therefore, we can differentiate innovative territories, which have been able to make technical progress, from those that have been left behind. For a territory to be innovative, it will depend on local resources and the decisions of local actors to meet the needs of the territory, which is why it is important how these interact and how they are able to take advantage of the comparative benefits that this sector has in order to add value to industry and to improve the quality of life in the region above all.

In the innovative process, the institutions aim to encourage relations between the different agents and to promote research. Therefore, the territory and innovation have a close relationship, both act with their resources for economic and territorial development, so that a territory will be innovative when it is capable of introducing innovation projects in its business network, in this case in the ceramic industry, and thus achieve local development.

According to Albuquerque (2004) local development is defined as "the process that improves the quality of life, overcoming difficulties through the action of different local socio-economic agents, with endogenous resources and promoting capacity enhancement". With local development, an improvement in the business network, an increase in employment and an economic improvement is achieved both for companies and for the territory in general, and thus a more sustainable territory is achieved by reducing environmental problems.

The communicative interaction between the institutions that determine innovation form a Regional Innovation System (RIS), this concept was first defined by the author Cooke in the early 1990s, which is reflected in the work of Mikel Navarro (2009); "the regional innovation system would be integrated by two subsystems of actors involved in interactive learning: a knowledge generation subsystem or regional support infrastructure, composed of public and private research laboratories, universities,

technology transfer agencies, continuous training centres, etc. and a subsystem of knowledge exploitation or regional production structure, composed mainly of enterprises, especially those with systemic characteristics" Cooke (1996, 1988 y 2001).

These open systems are in constant contact with agents from different national and international systems in order to exchange the knowledge generated by other systems, although the geographical concentration of agents helps the development of innovation in the system and reduces the costs of the process. Some agents do not have their physical headquarters in the territory of the Ceramic Agreement, but despite this, they actively intervene in programmes for the promotion of innovation, competitiveness, or employee qualification.

Among the functions of the RIS, we can highlight the involvement in promoting communication and between agents, providing complete information, resources, and incentives for innovation, and speeding up the transfer of technologies from one sector to another.

### 3.1 Territorial endowment

#### 3.1.1 Agents that generate innovation

We must point out, as Budí and Alamá (2020) have stated, the fundamental element for the promotion of innovation is the existence of a research centre or technology centre, which provides support for small and medium-sized ceramic companies. In our community, the Instituto de Tecnología Cerámica (ITC)<sup>3</sup> is one of the most important relationships between the University, the administration, and the tile sector. The ITC is more than 50 years old and was founded to help and participate in the needs of the ceramic cluster industries. It is a mixed university institute created by the agreement between the UJI and the Asociación de Investigación de las Industrias Cerámicas<sup>4</sup> (ITC-AICE) and is accredited as an innovation centre by the Comisión Interministerial de

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<sup>3</sup> Institute of Ceramic Technology (ICT)

<sup>4</sup> Ceramic Industries Research Association (CIRA)



Ciencia y Tecnología (Cicyt)<sup>5</sup>. It is located on the campus of the Universitat Jaume I and belongs to the network of technology centres of the Instituto Valenciano de Competitividad Empresarial (IVACE)<sup>6</sup>. The research centre must have the necessary means for the development of innovation and regional development. The main role of these centres is to create knowledge and ideas that must be transferred to companies and workers through different projects.

ITC's main objectives are to improve competitiveness in the sector and the dissemination and transfer of technology. The first phase is the creation of knowledge through research and technological development that will be transferred to companies in the sector in the second phase so that they can generate more innovative products and services; these are the fundamental phases for competitiveness and development. The third phase is the training that with the coordination of the technical team and the Universitat Jaume I, several courses have been given to transfer knowledge of innovative matter to workers of the sector. Finally, the ITC is responsible for carrying out a set of technological services such as testing, quality certifications, projects, and trials. Since its creation, the ITC has carried out 57 doctoral theses, published 696 scientific articles in journals and developed 691 public R&D&I projects, 1357 projects with private companies and nearly 475 different tests, as indicated on the ITC website.

In addition, 491 training courses have been held, courses that may be subsidized by the State Foundation for on-the-job training.

The confluence of ceramic companies in the province and the proximity between them favours the productive structure and the diffusion of technology; the socio-economic relations favour the process of transmission and creation of knowledge. The internal networks between companies and technology centres make ideas revert among them, reviving technical processes.

There is a positive relationship between the ITC and the regional development, therefore, the development of the ceramic sector is mainly thanks to the ITC research centre,

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<sup>5</sup> Interministerial Commission of Science and Technology (ICST)

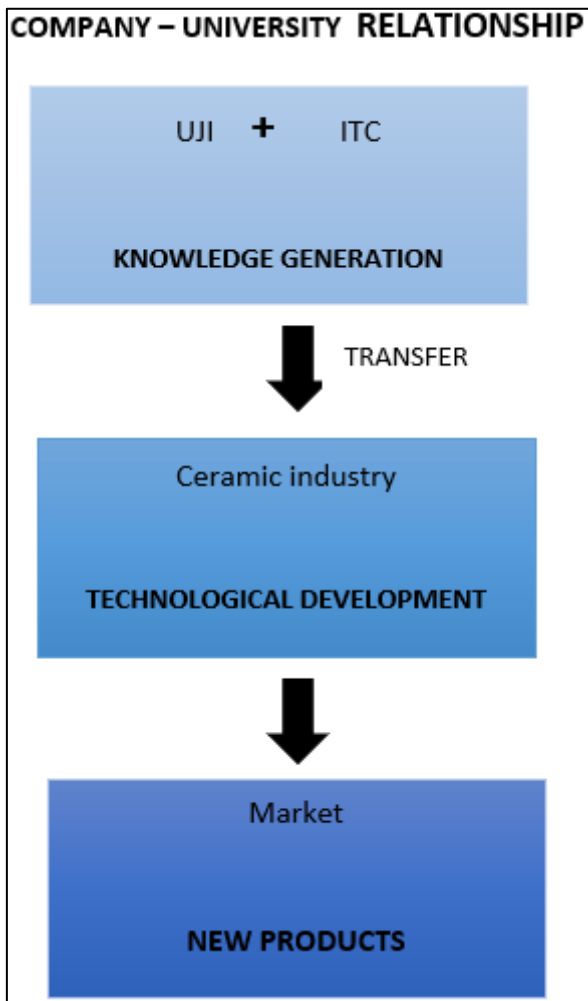
<sup>6</sup> Valencian Institute of Business Competitiveness (VICB)

favouring R&D&I. Another point supporting the existence of the ITC is that its relations with the companies means that the support that some companies have with direct aid for innovation from institutions or other public sources is reduced.

On the other hand, another agent that generates innovation is the university. An institution that traditionally has only been dedicated to teaching, but in the last 40 years it has evolved to participate actively in the generation of knowledge in the field of innovation with the help of public funding and to interact with companies to transfer this knowledge to them, which will immediately transform it into innovation.

It is in the United States where traditionally, universities together with public and private institutions have carried out research work that contributes to the development of technology and industry. European universities, however, have been one step behind but in the 90s, this trend began to change due to their weak international competitiveness, and the limited public funding for innovation also led to explore other paths of research. In this way, universities have been involved in industry, transferring their innovative knowledge, contributing to the training of employees and carrying out research projects that make innovation flourish, since, as we have said, it has a strategic influence.

**Figure 5: Transfer and innovation: UNIVERSITY – COMPANY**



Source: Own elaboration

The transfer of innovative knowledge to companies by universities also favours them, increasing their prestige and attracting more students and researchers.

The Universitat Jaume I, together with the ITC, carries out a great work in the elaboration of innovation processes for the companies of the municipalities that form the Ceramic Agreement. The Espaitec is the science and technology park of the Universitat Jaume I, according to the data on the ESPAITEC website, it is formed by research groups, public associations and around 28 companies with technological capacities such as, for example, Blue Plasma Power, CYE Energy and SACMI, among others. It currently offers 24 services among which we highlight the assistance in the search for funding for companies and the promotion of internationalization.

This space has been working on the creation of knowledge since 2007, providing innovation to the business network of the province of Castellón and generating wealth to it. It organizes projects in the national and international field, projects of innovative material such as *Knowledge Transfer Antennas*, *UJI>LAB* and *Technological Map of the province of Castellón*. All the projects were developed with the clear objectives of promoting cooperation between universities and companies and the circulation of knowledge between them and improving the competitiveness of the ceramics sector.

In particular, the first one has tried to reinforce the contact between researchers from the university and professionals from some companies to make the transmission of ideas less complicated. The *UJI>LAB* has been a merely experimental project in which the aim has been to convert ideas into real models. Finally, the *Technology Map of the province of Castellón* project has attempted to provide transparency to technology-based companies in the province and facilitate collaboration between them. They were carried out thanks to funding from the Instituto Valenciano de Competitividad Empresarial (IVACE) and the agreement with the Universitat Jaume I.

In addition to the ITC-University, another agent that conditions innovation in this sector is the Escuela Superior de Cerámica de L'Alcora (ESCAL), which was founded in 2005 in Alcora, a municipality that belongs to the Agreement and one of the most important ceramic producers in the province and in Spain. The students who study the Advanced Degree in Plastic Arts, specialising in ceramics, are trained to develop artistic, technological and research work, and thus be able to contribute with improvements in the manufacture and quality of ceramic products. This school belongs to the hard nucleus of the agreement since it is located in a ceramic municipality and, moreover, it acts directly in the local development through courses, conferences and projects that are initiated by the Ceramic Agreement with the aim of training highly qualified workers.

In conclusion, we consider that the ITC together with the University are the great creators of knowledge in this territory. They belong to the first phase of the technological process, and they oversee creating and transferring that knowledge to the business network through the projects mentioned above and undoubtedly, they are essential for the regional development.

### 3.1.2 Institutional support for the Agreement

In addition to the institutions that are in charge of the necessary research to generate innovation, there are public and private institutions and associations that have an impact on the innovation of the industry when the market is not able to do so, and institutional assistance is necessary, providing financial support, giving visibility to the sector at a national and international level or advising new entrepreneurs.

The connections between the institutions and the ceramic sector are important to stimulate the economy of the region. This means that improving innovation in companies depends to a large extent on how the institutions that regulate them are, on the budget allocated to research and development, and on the innovation, policies designed by governments. Policies that aim to improve communication between knowledge-generating infrastructures, companies, and institutions. In other words, innovation policies are responsible for guiding the different agents that make up the RIS and have a duty to respond to the different problems that arise in the field of innovation.

Several local, national, and international institutions finance and promote innovation in our ceramic industry forming a network between institutions and companies.

At a European level, Community funds such as the Fondo Europeo de Desarrollo Regional (FEDER)<sup>7</sup> and the Fondo Social Europeo (FSE)<sup>8</sup>, both of which aim to promote competitiveness, improve employee skills through quality education, support SMEs and stimulate innovation in all sectors, support Spain. The resources are managed by national institutions such as the Ministry of Economy and Finance.

On a national level, the Ministry of Science, Innovation and Universities is one of the departments of the General State Administration in charge of coordination between the different Autonomous Communities and of relations with other countries on innovative matters. It designs policies related to technological development and innovation, the

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<sup>7</sup> European Regional Development Fund (ERDF)

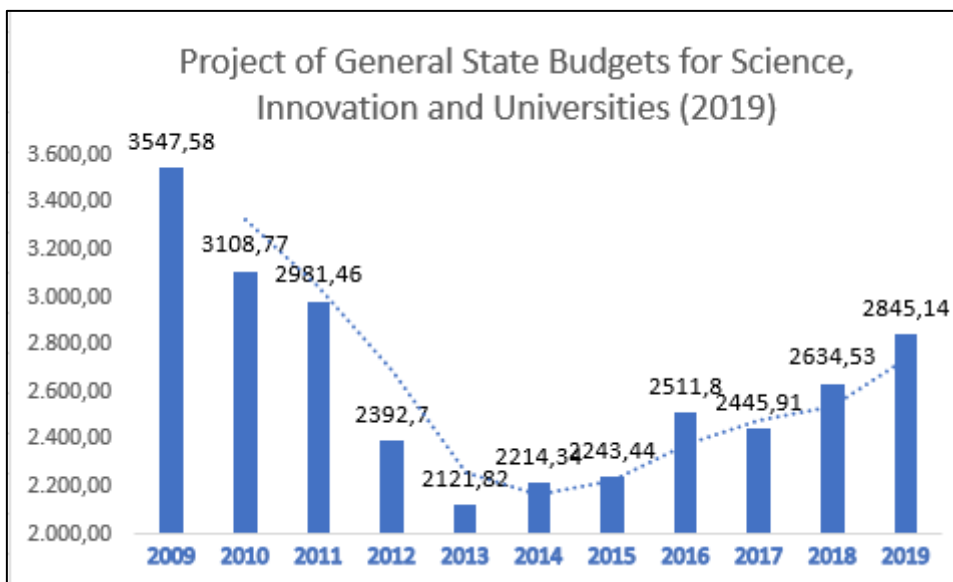
<sup>8</sup> European Social Fund (ESF)

objective of which is to reduce the cost of those companies that are adapting to technological development, through tax incentives, direct subsidies, or the creation of public infrastructures for development.

According to the data obtained from the Ministry of Science, Innovation and Universities (2020), in the year 2019, on a national level, 2,845.14 million euros were allocated to R&D&I and Universities, an increase of 8% as compared with the previous year, for carrying out innovation projects, scientific infrastructures, promoting research, etc. It is the Centre for the Development of Industrial Technology (CDTi) that handles the funding and acts as an intermediary between the institution and the company.

In the following graph we can see that the investment in funding with the lowest value is in 2013 with a budget of less than 2,220 million Euros due to the consequences of the economic crisis, but we must highlight the positive trend of recent years, although still far from the budget for innovation in 2009, and the average of European countries with high technological potential.

**Figure 6: Project of General State Budgets for Science, Innovation and Universities (2019)**



\*Vertical axis: millions of Euros

Source: own elaboration with 2019 data from the Ministry of Science and Innovation

According to the Regional Ministry of Innovation, Universities, Science and Digital Society of the Comunidad Valenciana (2020), in 2019, out of the total State Budget, 926 million Euros were spent in this area, an increase of 920 million Euros compared to the previous year, where more than 90% was allocated to universities. Around 60 million Euros were allocated to the field of Science and Research, of which approximately 90% was designated to grants for the creation of knowledge in research centres such as the ITC.

Around 25 million for the Agencia Valenciana de la Innovación (AVI)<sup>9</sup> and finally the technology parks, the Instituto Valenciano de Competitividad Empresarial (IVACE) or the Red de Institutos Tecnológicos de la Comunidad Valenciana (REDIT)<sup>10</sup> also benefited from the improvements in their budgets.

Other public institutions that support the companies of the Agreement include the Instituto de la Pequeña y Mediana Industria de la Generalitat Valenciana (IMPIVA)<sup>11</sup> currently called the Instituto Valenciano de Competitividad Empresarial (IVACE), which we have previously mentioned. considering the information published by the institute IVACE, this is a public law entity, integrated into the public sector of the Generalitat Valenciana. Some of the objectives of the Institute are to promote innovation and development, achieve energy efficiency and promote renewable energy, advising companies on their modernisation and development, facilitating public financing, marketing land for the construction of new companies or their expansion, monitoring the implementation of current regulations in relation to industry, reducing energy costs and increasing productivity, maintaining national and foreign investment, disseminating all projects relating to this sector and giving visibility to this very important industry in our province.

The IVACE, in cooperation with the European fund FEDER, promotes subsidies to SMEs, large companies and research centres for the industrial development and internationalisation of companies in the Comunidad Valenciana. On the other hand, the

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<sup>9</sup> Valencian Innovation Agency (VIA)<sup>9</sup>

<sup>10</sup> Network of Technology Institutes of the Comunidad Valenciana (NTIVC)

<sup>11</sup> Institute of Small and Medium Industry of the Generalitat Valenciana (ISMIGV)

institute also acts individually with national projects such as aid to promote renewable energies, energy efficiency and the creation of sustainable industries.

At a national level, 43 years ago the Asociación Española de Fabricantes de Azulejos y Pavimentos Cerámicos (ASCER)<sup>12</sup> was created, although its headquarters are located in Castellón due to the fact that it is the province where most of the ceramic companies are located. It is the ceramic employers' association by excellence and one of the most important sectorial associations in the country because of the existing productive concentration in our province. It brings the industry's executives together and its functions include providing support to the ceramic sector, cooperating with the companies, and representing them at a provincial, national, and international level. Some of the most important projects carried out by this association have been the DRAC project, in 2005, in which IVACE, ITC, the Regional Ministry of Science and University and the Instituto de Biomecánica de Valencia (IBV)<sup>13</sup> had also been involved.

The objective of the DRAC project was to determine different guidelines to promote the ceramic industry by considering human capital in the value chain. The result of this project was disseminated to more than 200 companies in the sector.

With the results of the previous project, the 4Senses Project was elaborated, the purpose was to generate knowledge about the relationship between the human being and his sensations with the environment, and thus, develop new innovative products in the sector.

It is regarded as the most important project in the field of innovation as it was conducted with a budget of 9 million euros and involved, in addition to ASCER, the IBV, ITC, UJI, FEDER and companies in the ceramic sector such as Esmalglass and TAU Cerámica.

The origin of the project is the National R&D&I Plan, which is included in the Ministry of Science and Innovation's Programme of Singular and Strategic Projects, whose aim is

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<sup>12</sup> Spanish Association of Manufacturers of Ceramic Tiles (SAMCT)

<sup>13</sup> Institute of Biomechanics of Valencia (IBV)



to promote innovation and turn the current economic model into a more sustainable and innovative one.

Another organization that influences innovation is the Centro Europeo de Empresas Innovadoras (CEEI)<sup>14</sup>, its function is to help and advice entrepreneurs who have innovative initiative. At regional level, the European Centre for Innovative Companies in Castellón is a non-profit association that has been providing its services for 23 years and is part of the IVACE Technology Centre Network. It also cooperates with the Regional Ministry, the Provincial and City Councils of Castellón, the UJI and ASCER, among other agents. One of its last actions was in 2019 and it acted as a financial intermediary between some companies in Castellón and the European Fund FEDER. 1,142,500 Euros were allocated for the growth of these companies, as stated on the CEEI Castellón website.

With respect to the local endogenous agents that actively participate in the sector, we can name the Globalis Foundation and Noves Sendes Foundation, both are social foundations that work for local development, business, and social innovation. The Efecte Vila-real Foundation belongs to the Caixa Rural Vila-real banking institution and acts as support for entrepreneurs.

In addition, the governments of the various autonomous communities offer aid and carry out programmes for the development of innovation and the internationalisation of companies, for example through the chambers of commerce.

We have considered that the institutions, associations, and foundations named in this section are the most relevant in promoting innovation in the ceramic sector; however, there are more associations that condition innovation both locally, nationally, and internationally. They belong to the hard core of the Agreement for the Employment of the Ceramic Municipalities and all of them form the Regional Innovation System, the cooperation between them allows regional development to be satisfactorily achieved, moreover it is also the companies that coordinate with the previous institutions to be able to benefit from the knowledge generated, for example, by the ITC or the UJI, and

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<sup>14</sup> European Centre for Innovative Companies (ECIC)

immediately transform it into innovation and progress, or to benefit economically with funds from institutions such as the FEDER or the Generalitat. Therefore, it is essential that institutions and businesses be in a constant relationship.

### 3.1.3 Company ranking

One of the most important parts of the technological process are the companies, as they are the ones that transform the innovation into products to be marketed, while the other actors are the ones that speed up the process.

In recent years, ceramic companies, like the rest of the industries, have had to overcome the obstacles of globalisation, such as intense competition in the tile market, with large competitors such as China and Italy, new environmental laws or adapting to technological changes. To face these challenges, they must initially have the capacity to absorb the knowledge generated by the ITC and the university; this capacity is considered a comparative advantage over companies in the sector that are not capable of incorporating it in order to be more competitive and grow technologically. They must then incorporate this knowledge into their production process to achieve new products of higher quality and more competitive on the national and international markets.

According to ASCER data for 2019, the province of Castellón has approximately 200 companies that are specialized in the production of tiles; the operations of these companies have a total value of around 3.760 million euros per year. As we have described in previous sections, this is the province where most of these producers are located and it offers direct employment to more than 15,000 people. This sector represents 40% of the province's GDP and is characterised by small and medium sized companies, although in recent years some have increased their size as a business expansion strategy, with the appearance of some multinationals and groups of companies such as the Pamesa Group, which ranks fourth in world production.

Companies such as PAMESA S.L., PORCELANOSA S.A., TORRECID S.A., ARGENTA S.L, COMPACGLASS S.L, TAU S.L, VENIS S.A, KERABEN GRUPO S.A, SALONI S.A, GRESPANIA S.A, and MARAZZI IBERIA SL, should be highlighted, as these are the 10

companies with the highest turnover in sales in the province. The above companies are in the province of Castellón, exactly in municipalities that form the Agreement such as Almassora, Vila-real, Onda, Sant Joan de Moró and L'Alcora.

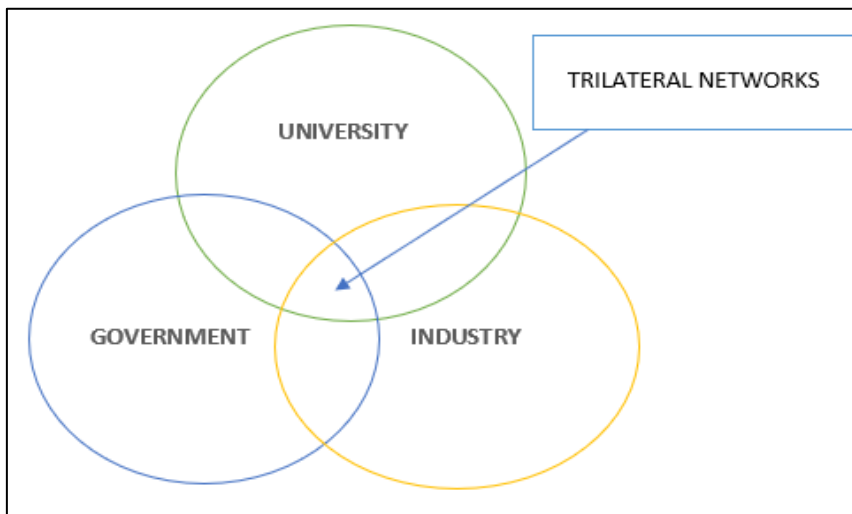
These companies form the Regional Innovation System together with the other agents and are considered the "exploiting" agents, since they are the ones that turn the innovation generated by the University-ITC into an instrument of competitiveness. The concentration of these companies in the territory facilitates the connection between the institutions that many of them are also geographically located in the province of Castellón, and the concentration of ceramic companies in the same territory favours the formal and informal exchange of knowledge between them.

### 3.2 Interaction between agents

In summary, the relations between the knowledge-generating agents, the institutions and the business network are key to the innovation process, and have been studied over time by researchers such as Etzkowitz and Leydesdorff (2000), who worked to define the Triple Helix model.

According to the authors, the model gives the universities a more important role in innovation, exposing that as a result of the cooperation and relationship between these agents, trilateral networks are formed, which consist of any of the agents being able to carry out other work that is not within their traditional functions. It also points out that innovation policies are born from the relations between the agents and not only from the state; these should not be, or they would lose all their effectiveness. All the authors mentioned above highlight the knowledge generated by the university as the essential part of technological development, and companies are increasingly dependent on it to maintain their leadership in the sector.

**Figure 7: Triple helix model: University - Government – Company**

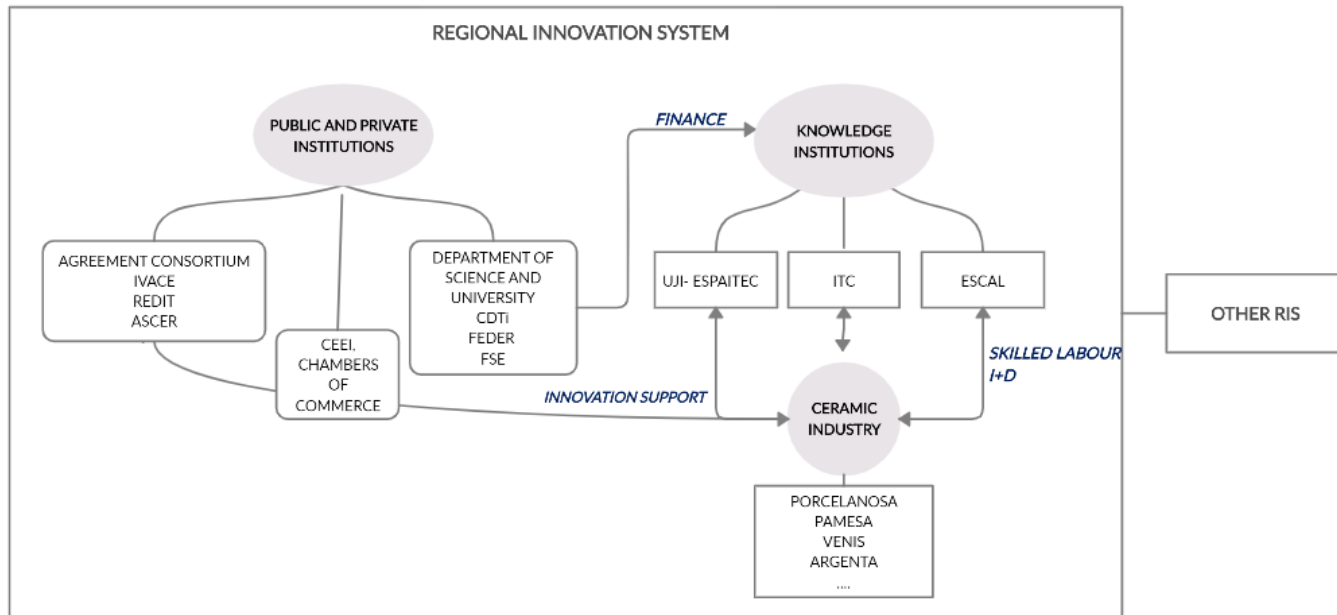


Source: Own elaboration reflected by figures in the article by Etzkowitz and Leydesdorff (2000)

This model aims to define the relationships between the various agents that condition innovation, favour the economic development of a region, and form the Regional Innovation System.

To design the following conceptual map on the interaction of the different agents we have chosen some of the public and private institutions that intervene in some way in the development of innovation and some of the ceramic companies that absorb the knowledge generated by the university-ITC and transform it into innovation.

**Figure 8: Regional Innovation System**



Source: Own elaboration

As can be seen in the conceptual map, knowledge-generating institutions rely on public funding from the Ministry of Science and University, or European funds such as the FEDER or FSE, and therefore depend on this funding to carry out their activities. Knowledge institutions such as the university, the ITC or the Escal, transfer the knowledge and technological capabilities generated by research teams and professionals in innovative matters, through a multitude of projects and training courses aimed at employees in the ceramics sector. The companies in the sector receive aid from associations such as ASCER, IVACE, CEEI, the Chamber of Commerce, or the Ceramic Agreement. This aid can be through proper business advice, representation of the sector or courses that train workers. Once the business network has absorbed the innovative ideas generated and the financial aid, they would be able to reflect their technological development in more competitive products for the market

Relations between the agents that make up the RIS are obstructed by factors such as the existence of bureaucratic obstacles, the lack of knowledge on the part of some companies of the range of aid available to them, which leads to low participation by these companies in technological development, insufficient public funding and a low political commitment to innovation that prevents R&D&I activities from being carried out. Spain

is below the European average in terms of spending on innovation projects. To solve these weaknesses, it is important to put forward some key proposals that can improve in the short and long term the development of our province and in general of the whole country.

## 4 Innovation proposal

In line with the ideas proposed by the COTEC foundation (2019), firstly, the increase in the importance of investment in R&D&I by the public administration is considerable, although in recent years, after the previous financial crisis that hit the country, an increase in the amount of the budget for this area has been observed, it continues to be below the European average and this leads to a delay with respect to the other countries with which the ceramic industry competes. The increase in project financing would make it easier to create and transfer knowledge, and therefore to develop innovation to make companies in this industry more competitive with the rest of the world's ceramic producers.

Another proposal in relation to the previous one is to increase the importance of universities in the innovation process, to provide these institutions with mechanisms to ensure the transfer of innovation from university to business, to consolidate high quality training of students and teachers in the scientific field, to facilitate the work of these institutions by reducing dependence on other public bodies, to facilitate the recruitment of researchers through the granting of aid and subsidies, and to expand the infrastructure of technology centres.

It is imperative that more researchers and scientific personnel work in ceramic companies, intensifying the university-company relationship. Universities must be an essential engine of the economy.

Another disadvantage we find in the process is that many companies do not know how to access the knowledge generated by the university and technology center. To solve this problem, it is necessary to improve the system of coordination between business and university, a strategy that would promote the transfer of knowledge and the results

would be successfully reflected in the productive network. It is essential to eliminate the barriers that delimit cooperation between knowledge-generating institutions and companies to increase the technological demand of companies as a whole and allow them to benefit from the advantages of innovation.

Furthermore, relations between companies in the same sector would make it possible to exchange experience and increase their opportunities.

On the other hand, a correct design of innovation policies that support the private sector would encourage the creation of new technology-based companies, increasing R&D&I funding, reducing bureaucratic procedures, facilitating access to funding and promoting tax incentives for those companies that opt for innovation. It is very important to create organisations that offer support to these new entrepreneurs for local development and that give visibility to existing projects and aid in this field so that all companies benefit from complete information.

These are some of the proposals for the future, with the aim of addressing the different problems that exist between the relations of the agents of a RIS. Without doubt, the public sector, companies and, indirectly, the whole society would benefit if the above proposals were implemented.

## 5 Conclusions

We have carried out a general review of the economy of the province of Castellón through the diagnoses carried out during 2017 by the Avalem Territori programme in collaboration with LABORA. The territorial diagnoses for 2020 are currently being carried out and this programme aims to define new territorial policies according to the current needs of the population and the sector.

After analysing these works, it is clear that the ceramic sector is one of the most important due to the great concentration of its productive structure in our province, and for which the Agreement for Ceramic Employment studies and works to promote its market and

improve the quality of employment. This sector has a comparative advantage, compared to other economic sectors, which we have talked about throughout the work, the innovative capacity, an important advantage in the globalised and competitive world in which we live.

We have identified the main public and private institutions that have an agreement on innovation, such as the Universitat Jaume I with the Instituto de Tecnología Cerámica (ITC), the Instituto Valenciano de Competitividad Empresarial (IVACE) or the Centro Europeo de Empresas Innovadoras (CEEI), and how these relate to and cooperate with companies in the Regional Innovation System. We have observed some problems in the coordination of the agents that form this system and that slow down the execution of the innovation process, such as the lack of information of some companies, the limited budget and the scarce financing for research, the lack of political support, etc. To try to solve these issues and encourage innovation, we have put forward some proposals in the previous section, which will manage to strengthen the system and the relationship between the private and public sectors.

A correct functioning of RIS favours the advance of innovation in the sector, allowing companies to be more competitive and efficient compared to the exterior ones.

In line with the current situation, due to the pandemic originated by the Covid-19, the whole society is going through a strong health and economic crisis; all sectors of our country are being affected by this complicated situation in which they have to ask for support from public institutions. Specifically, the ceramic sector is in a similar situation to that experienced with the crisis of the previous decade, in which many companies went bankrupt and others managed to survive thanks to the increase in exports to countries such as France, the United States, the United Kingdom or Germany. It is essential, in these difficult times, that the Employment Agreement consortium and the other agents we have mentioned in this paper study in depth the needs of this sector and of the more than 15,000 employees who are directly related to this industry. This is a key moment for the institutions that offer support to the sector to cooperate, execute correct employment policies, and aid funds so that the impact of the crisis is as minimal as possible and does not destroy hundreds of jobs.



In this time of economic uncertainty, as in previous crises, innovation plays an important role in overcoming this situation, it is the tool for achieving economic growth and therefore it is important that a fair part of the general budget continues to be allocated to innovation and development, so that knowledge continues to be generated and transferred to companies. Only in this way can they be more competitive and survive in these difficult times for the economy.

In conclusion, public institutions and businesses must continue to commit to technological progress as a means of economic and social development for the entire region.

To end this project, I would like to share the words of the economist Joseph Schumpeter (1935) in his book "The Analysis of Economic Change" published in 1935: "Having classified all the factors that can cause changes in the economic world, I have come to the conclusion that, apart from external factors, there is a purely economic one of capital importance, and which I have given the name of innovation".

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