

THE “PULL EFFECT” OF THE CASTELLON CERAMIC CLUSTER

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INTRODUCTION – OBJECTIVE

The Castellon ceramic cluster has been studied from many points of view, although very little from the perspective of its **pull effect** on companies belonging to the cluster or on other related companies.

Pull companies are those that promote economic growth and development.

They exert traction vertically towards their supply vendors, whether they are at the initial level or secondary further down the chain.

The literature points to a series of advantages that pull companies offer:

- As corporations, they tend to have a well-defined organisational structure.
- Their human capital is usually qualified and competitive.
- They are innovators and significant activators of economies at regional and national levels.
- They generate both direct and indirect employment.
- They help other companies grow by outsourcing services.

Pull companies are large enterprises that promote economic growth and development, since most of them are large nationally or internationally.

"A company of such size and importance that its growth generates a significant expansion of economic activity in terms of employment and investment, being able to act as a vehicle through which other companies can market their products and services as its suppliers." (A Local Entrepreneurship Review: The State of Sinaloa, OECD 2004).

"Those that generate or are able to generate an important multiplier and innovation effect on the productive activity of a specific region" (Innovation Strategy of Andalusia 2020).

"Those that have the capability of improving and/or boosting the economy in their immediate environment, taking into account their size and/or ability to create business upstream among their suppliers or subcontractors, or downstream among their local customers" (R&D&I pull projects, RIS3 Strategy of Asturias, 2014).

They exert traction vertically towards their suppliers. As "trailers", suppliers can be classified either as:

- Top-tier suppliers
A Top Tier supplier has sufficient technical, human and financial resources to be able to offer complete series with great added value in terms of design and engineering.
- Second- and third-tier suppliers.
Suppliers of parts whose designs are supplied by the top-tier supplier. They generally supply relatively basic commodities and individual parts.

Pull companies are great generators of employment and activators of economies, especially in the area where they are located, and also at global level.

These companies embody an activation of the economy by generating both direct and indirect employment by outsourcing to other companies (mostly fast-growers and SMEs).

Innovation capabilities and relationships with their territory

There may be several factors that make certain companies more innovative than others or with a greater ability to innovate (Hii, J. and Neely, N. (2000). "Innovative capacity of firms: or why some firms are more innovative than others". 7th International Annual EurOMA Conference 2000, Ghent.)

Among these factors, **territory** is cited as a factor to be taken into account when studying firms' innovative capacity. **Such innovation must be associated with national, regional and sectorial innovation systems and based on:**

- *Enterprises.*
- *R&D&I organisations.*
- *Political institutions.*

Territory is the point where these actors meet (Méndez, R. (2002). "Innovación y desarrollo territorial: algunos debates teóricos recientes (*Innovation and territorial development: some recent theoretical debates*)" EURE vol. 28, No. 84, 63-83). One way of explaining this is by means of the Triple Helix Model.

The "milieu" concept on which business clusters are based defines a system of economic, political and institutional actors (triple helix) and socio-cultural agents located around a specific territory that is not only the physical medium where they are located, but also implies the place where they use their capacities and exchange knowledge, resources, goods and services.

A highlight of such agents/resources is *relational capital*, which can be seen as the possibility of co-operation between companies, institutions and people located in the same territory.

Thus, when pull companies come into contact with the territory, the variable of purchase, production and sales, which embodies suppliers, internal logistics and production systems, environment and quality, and subsequent distribution or external logistics, arises.

Another variable to be studied is the exchange of information between members of the cluster. All this is present and conditioned by the territory.

From the above, one can conclude that **suitable management of the resources present in the territory enables a greater capacity for innovation to be achieved**, both in the pull company and in the firms related to it ('trailers'), who are mostly SMEs. See "*La Innovación territorial y el empleo en la Comunidad Valenciana (Territorial innovation and employment in the Valencia Region)*". Universitat de València 2020, a study project co-ordinated by Jorge Hermosilla.

The purpose of this research is to analyse the pull effect the cluster plays by identifying pull companies and studying their effect. More specifically, it focuses on whether "innovation" is part of that pull effect within the cluster.

The research starts with the SABI database on companies in the province of Castellon (focusing on those belonging to the ceramic cluster), and selected “pull companies” by applying a criterion based on size, turnover, employment generated, ability to generate added value, growth over time, and fixed asset value. Subsequently, the effect of innovation was added.

A criterion for selecting “pull companies” taken from a similar study (*“Estudio de investigación sobre las empresas tractoras de Asturias” (Research study on pull companies in Asturias)* 2015. IDEPA Institute of Economic Development Principality of Asturias) was applied in order to use homogeneous criteria to enable full comparison.

Thereafter, in order to expand the criteria taken from the SABI database, a questionnaire was sent out to the pre-selected pull companies to ascertain their “towing” capacity with respect to suppliers within the geography and their innovation capabilities. The questionnaire was sent to 100% of the companies classified as pull companies. The number of respondents and the degree to which it is representative are shown on the results sheet.

To further the work presented here, analysis could be made of:

- Ways in which collaboration between pull companies and their vertical chain can be fostered in order to enhance such collaboration and extend it horizontally to gain competitiveness in the territory.
- An assessment, within the relational capital, of the impact that recent acquisitions and mergers are having on the relationship capacity between people belonging to the cluster and, by extension, to the companies considered pull companies.

EXPERIMENT

As stated in the introduction, the starting point to undertake this work was **the operational guide previously presented in the IDEPA project.**

To identify pull companies, the SABI database was used in tabulated form with analysis of the following variables:

- Company and identification details.
- Geographic location.
- Business sector (CNAE) (*Spanish Business Activity Code, BAC*).
- Size based on:
 - Number of workers.
 - Sales Turnover.
 - Fixed Asset Value.
 - Added value.
 - Operating profits.
- Years researched: 2016-2017-2018

The following classification was used for pull enterprises:

- I. **Large companies:** Defined by their size. They are considered large if they meet a). Even if they do not fulfil that condition, they are still considered large if they attain b) and c) simultaneously:
 - a. Employees >250; **or failing that...**
 - b. Revenues >€50 million
 - c. Assets € >€43 million
- II. **Sustained contribution:** Companies that have an upward or growing trend:
 - a. In employment.
 - b. **Or** in Gross Value Added (GVA) in the two periods between **tax years.**
- III. **Positive contribution: High Contribution firms**, i.e., companies that come:
 - a. within the first range of 0% to 90% contribution to growth
 - i. in employment.
 - ii. **or** in GVA in at least **one of the two periods** between tax years.

Large companies that are genuinely pull companies are those that meet:

- **Conditions I and II,**
- **or** those that **meet** conditions **I** and **III.**

One of the difficulties of this work was to sort companies by their CNAE (*Spanish Business Activity Code, BAC*) (to facilitate tracking and calculations), since companies may be in the same sector (tile manufacturers) but with different CNAE.

The following CNAE were used:

BAC	TYPE OF COMPANY
2331	Ceramic tile manufacturers
2332	Ceramic tile manufacturers
2030	Manufacturers of frits, glazes and ceramic colours
2339	Manufacturers of spray-dried powder
2349	Manufacturers of spray-dried powder
2892	Machinery manufacturers

Table 1. CNAE or BAC code of selected companies.

Companies in the cluster were counted and sorted into Groups I, II and III according to criteria a), b) and c) above.

Likewise, companies in each province – Castellon, Valencia and Alicante – were counted.

Those in other clusters were also counted in order to verify if ceramic is an isolated case within the Valencia Region.

Subsequently, all the companies identified as pull companies were sent a questionnaire (June-July 2020) (See Table 5) in order to ascertain their “towing” capacity in respect of suppliers within the territory, as well as their innovation capacity.

RESULTS AND DISCUSSION

Based on the above classification, the following tables have been drawn up:

- With the data from CASTELLON:

Group	Total province	CLUSTER							Rest of province
		LC+SG	LC+HC	LC+SG+HC	True pullers	Tiles	Glazes	Other clusters	
I	204	52	64	47	71	20	7	6	133
II	12	0	1	1	1	-	-	-	11
III	97	0	1	1	1	-	-	-	96
TOTAL	313	52	66	49	74	20	7	6	240

Table 2. Number of companies per Group and criterion (Castellon).

LC: Large company; SG: Sustained growth; HC: High contribution (See values in previous explanation)

- Over 50% of true pull companies in the province of Castellon belong to the ceramic cluster.
 - These true pull companies are generally LC (large companies) and meet the requirements of Large Company (LC), Sustained Growth (SG) and High Contribution (HC).
- With the data for the whole of the Valencia Region:

	Valencia			Alicante			Castellon		
	GI	GII	GIII	GI	GII	GIII	GI	GII	GIII
True pullers	168	3	13	79	1	2	69	1	1
Total pullers	184			82			71		
Total by Group	645	52	359	317	51	468	204	12	97

Table 3. Provincial distribution of the different groups (GI, GII and GIII) as well as of true pull companies.

- Castellon is the province that, proportionally, has more pull companies.
- Castellon is the province that, proportionally, has more pull companies within GI.
- Alicante has proportionally more in GII (considering the size of the province) and especially in GIII.
- No other cluster (using CNAE/BAC) has such a concentration of pull companies as ceramics, perhaps only what could be called Agri-food in Valencia, with 47 companies.

At this point, one might ask: Are the pull companies in the Ceramic Cluster of Castellon innovative? Are they innovative compared to the rest of companies in the Valencia Region?

It is clear that responses to such a survey have a high degree of subjectivity depending on the person responding. However, given the level of responses, it is considered valid in line with other research papers (Bontis, N. and Fitz-Enz, J. (2002) *"intellectual capital ROI: a causal map of human capital antecedents and consequents"*. Journal of intellectual capital. Vol 3, No. 3, 223-247).

Likewise, given that the survey was only sent to pull companies (the largest, most professionalised, most international, and with more resources), it is biased in that direction and the results cannot be extrapolated to all companies in the Valencia Region.

The technical data sheet for the study is shown below:

Pull companies in the province of Castellon	
Sampling technique.	Random sampling for convenience.
Information collection technique.	Online questionnaire.
Sample size.	45 companies in the province of Castellon.
Sample geographical scope.	Pull companies in the province of Castellon.
Date field work completed.	July-December 2020.

Table 4. Technical data sheet of this research.

A structured questionnaire (See Table 5) was used, consisting of a total of twenty-two questions assessing the extent of respondents' agreement based on a Likert scale of 1-7.

The results were obtained by different statistical techniques, all of which using the IBM's Statistical Package for Social Sciences Statistics 23. Concerning the results obtained in the survey, it is worth mentioning:

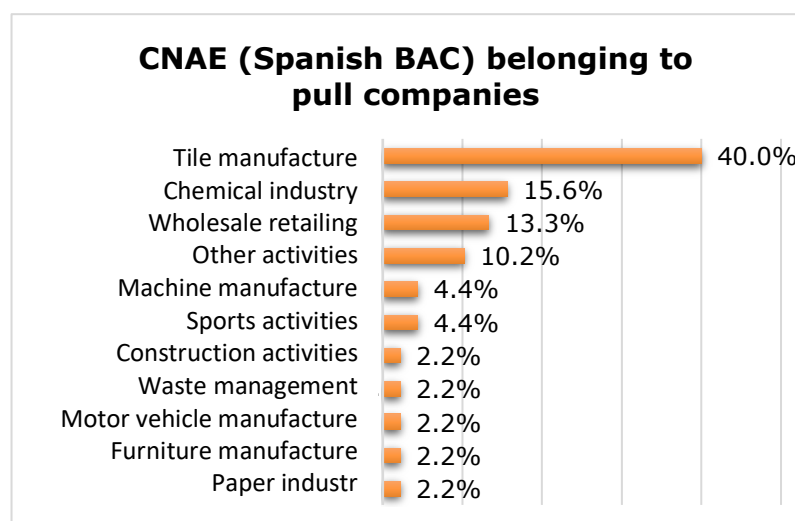


Figure 1. Sectoral distribution of the sample

As can be seen, 40% of pull companies come from tile manufacturing, followed by the chemical industry (15.6%), retail wholesalers (13.3%), and other professional activities (10.4%). These three groups represent 80% of the sample under analysis. From there on come machinery manufacturers and sports businesses, with 4.4% respectively. Finally, construction, waste collection and treatment, car makers, furniture producers, and paper industries (2.2%). This means that over 50% of the pull companies in Castellon belong to the ceramic cluster.

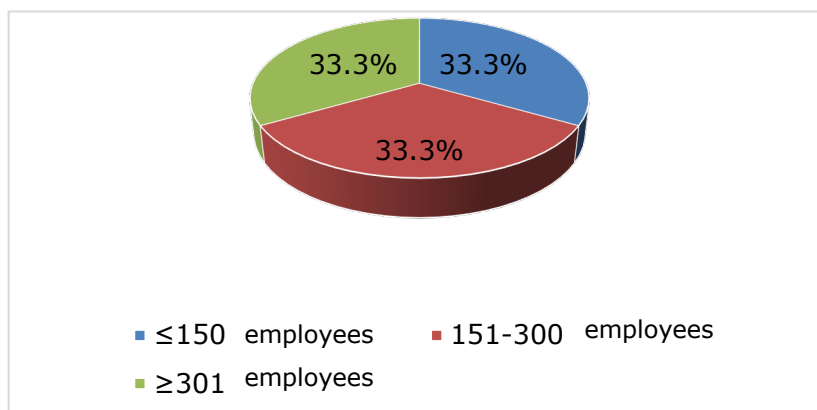


Figure 2. Size of companies by employees and their distribution.

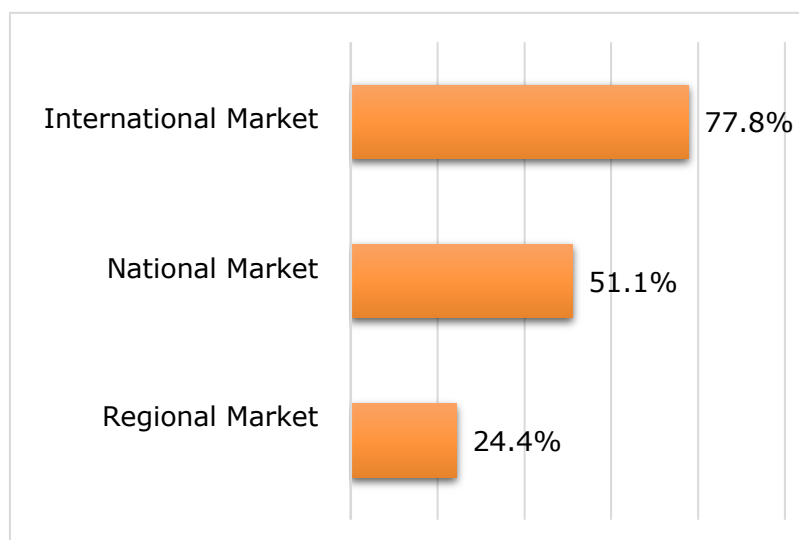


Figure 3. Market scope.

In regard to the pull companies' market scope (Graph 3), 77.8% state they operate on the international market, followed by 51.1% on the Spanish market, and finally 24.4% on the regional market. They are thus largely exporting companies.

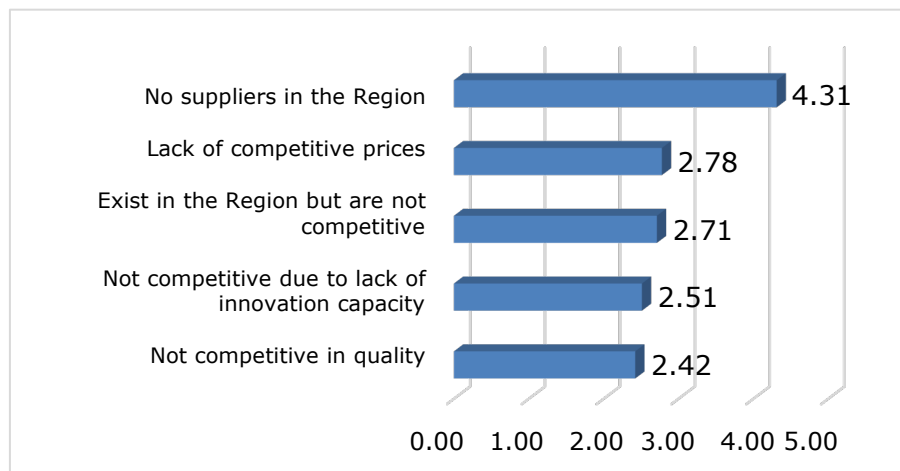


Figure 4. Reasons impeding greater amounts of purchases or contracts in the region (Rated 1-7, where 1 is disagree and 7 totally agree).

84.4% of pull companies claim that only 0% to 20% of the products and/or services they market were made outside the Valencia Region.

53.3% of pull companies in the province of Castellon procure between 60% and 80% of their components from other companies in the Valencia Region. If those that purchase 40-60% of their procurement are added, the percentage rises to 64.3%. They purchase mainly in the Valencia Region and when that is not the case, the reasons are as shown in Figure 4.

But are they innovative as well as pullers?

The responses given concerning experience in innovation by pull companies appeared in a total of seventeen headings and are shown below (Table 5). Again, this was performed with a Likert scale of 1-7, where 1 is total disagreement with the statement and 7 total agreement. Broadly speaking, the results obtained are quite high, with ratings over 3.5 in fourteen of the seventeen headings. At the top of the table comes investment in technology to produce new products or improve processes (5.76), followed by the use of external knowledge (5.49) and collaboration with customers and suppliers (5.18). The existence of an Innovation Department or similar also holds one of the highest positions (5.24).

At the opposite end comes the financing of innovation with public aid (2.84), the payment of licenses, and the registration of patents - (3.4) and (3.07) respectively.

Heading	Score
2.5.4 – Has invested in technology to produce new products or improve processes	5.76
2.5.7 – Uses external sources of knowledge (suppliers, customers, competitors, consultants...)	5.49
2.5.2 – Has introduced product, process, commercial or organisational innovations	5.44
2.5.3 – Has an Innovation Department	5.24
2.5.6 – Collaborates in innovation with customers and suppliers	5.18
2.5.1 – Has a clearly defined innovation strategy	5.11
2.5.15 – Measures innovation results	4.60
2.5.5 – Leads its supply chain, involving suppliers	4.60
2.5.11 – Carries out innovation projects in collaboration with other organisations	4.49
2.5.9 – Leads diversification into new products and markets	4.44
2.5.10 – Participates in projects with other knowledge centres	4.29
2.5.8 – Collaborates in the introduction of technological or organisational innovations in its vendor network	4.22
2.5.12 – Participates in public-private partnership projects	3.84
2.5.14 – Leads business co-operation networks in its own sector	3.76
2.5.16 – Has registered patents or utility models (or is in the process)	3.40
2.5.17 – Has made payments for technology licenses	3.07
2.5.13 – R&D&I projects are financed by public aid	2.84

Table 5. Analysis of overall innovative performance in pull companies

It can be concluded that they are innovative and that they focus their innovation activity with other agents in the chain present in the territory.

Statistical analysis of cluster or conglomerate data

Although we found significant differences between companies based on the sector they belong to and their scope of action, it was considered necessary to make a classification not solely based on one single criterion but rather one that created groups that are homogenous within themselves but heterogeneous among each other. For this purpose, Cluster or Agglomerate Analysis was performed, more specifically, under a hierarchical conglomerate method using the Ward Method, which produced two groups of differentiated companies (Table 6), based on the assessments made in the questions related to innovation practices (2.5.1 to 2.5.17 in the questionnaire).

The first group, or **"Innovation+"** group, was composed of a total of 23 companies with the highest scores in the evaluations about innovation practices, so it can be deduced that the most innovative companies must be included. On the other hand, the second group comprised 23 companies, the runners-up in the evaluations of the above-mentioned headings, so the Group is named **"Innovation-"**.

Heading	Innovation +	Innovation -
2.5.1 - Has a clearly defined innovation strategy	6.52	3.63
2.5.2 - Has introduced product, process, commercial or organisational innovations	6.65	4.18
2.5.3 - Has an Innovation Department	6.60	3.81
2.5.4 - Has invested in technology to produce new products or improve processes	6.73	4.72
2.5.5 - Leads its supply chain, involving suppliers	5.65	3.50
2.5.6 - Collaborates in innovation with customers and suppliers	6.26	4.04
2.5.7 - Uses external sources of knowledge (suppliers, customers, competitors, consultants...)	6.26	4.68
2.5.8 - Collaborates in the introduction of technological or organisational innovations in its vendor network	5.34	3.04
2.5.9 - Leads diversification into new products and markets	5.74	3.10
2.5.10 - Participates in projects with other knowledge centres	5.43	3.09
2.5.11 - Carries out innovation projects in collaboration with other organisations	5.91	3.00
2.5.12 - Participates in public-private partnership projects	5.08	2.54
2.5.13 - R&D&I projects are financed by public aid	3.65	2.00
2.5.14 - Leads business co-operation networks in its own sector	4.95	2.54
2.5.15 - Measures innovation results	5.87	3.27
2.5.16 - Has registered patents or utility models (or is in the process)	4.34	2.40
2.5.17 - Has made payments for technology licenses	2.39	1.35

Table 6. Average scores in the two groups of companies from the Cluster analysis.

Characterisation of the "Innovation+" group

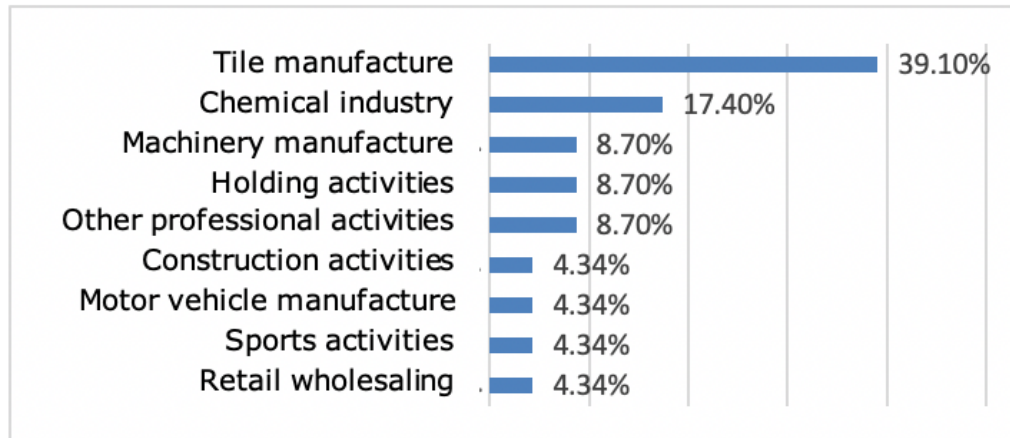


Figure 5. "Innovation+" group or agglomerate in Cluster based on CNAE/BAC

When these companies' CNAE or Business Activity Code is analysed (Graph 5), manufacturers of ceramic tiles and the chemical industry account for 56.5% of the members of the group, followed by small percentages in machinery manufacturing, business holdings, and other professional activities (8.7% for each).

Characterisation of the "Innovation-" Group by CNAE

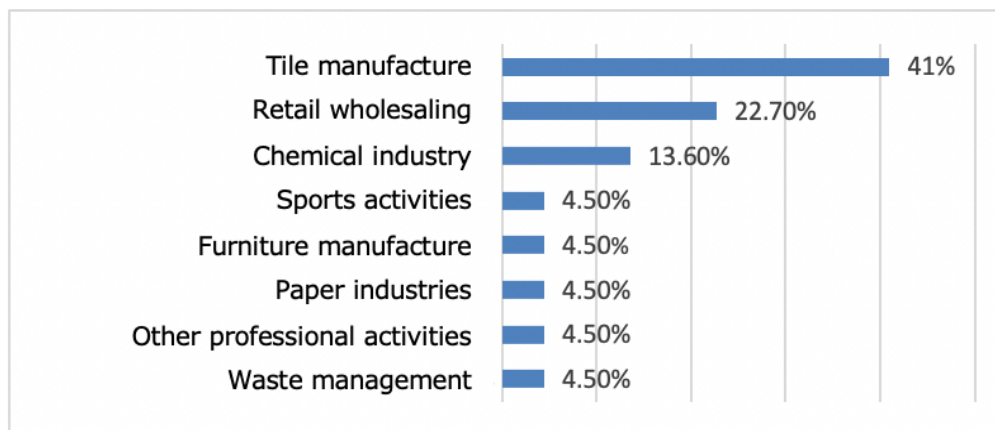


Figure 6 – 'Innovation-' group or agglomerate in Cluster based on CNAE/BAC

This section illustrates the second group of companies, known as the "Innovation-" group, which comprises a total of 22 companies (Graph 6). As in the previous case, tile-making represents the largest percentage (41%). However, in this group the Business Activity Code for retail wholesaling and intermediaries is seen to be significant at 22.7%, compared to 4% in the "Innovation+" group. Along with the chemical industry (13.6%), they account for approximately 80% of the group.

Graphs 5 and 6 show that not all pull companies are necessarily innovative.

A comparison was made with a sample of pull companies in the provinces of Valencia (16) and Alicante (14).

After a preliminary evaluation of the results using Province as a variable factor in an ANOVA analysis of the issues raised in Table 5, the following conclusions can be drawn:

- The only significant differences in the preliminary assessments between provinces are found in questions: 2.5.3, 2.5.11, 2.5.13 and 2.5.15, which means that the results presented herein can, to a certain extent, be generalised at a preliminary level.

Note: These data need to be confirmed with a larger sample from Valencia and Alicante, since the variations found may indicate differences in the way R&D&I is handled in pull companies in Castellon and Valencia or, in other words, such further analysis would enable those differences to be compared in view of the dominant sectors.

Heading	CST	VLC	ALC
2.4.1 – It is not possible to find suppliers in the Valencia Region (VC)	4.31	5.12	5.42
2.4.2 – Although there are suppliers in the VC, they are not competitive	2.71	2.68	3.07
2.4.3 – These suppliers lack competitiveness because of price	2.78	3.06	3.14
2.4.4 – These suppliers lack competitiveness because of quality	2.42	2.87	3.00
2.4.5 – These suppliers lack competitiveness because of innovative capacity	2.51	2.81	3.07
2.5.1 – There is a clearly defined innovation strategy	5.11	6.06	6.07
2.5.2 – Has introduced product, process, commercial or organisational innovations	5.44	6.31	6.00
2.5.3 – Has an Innovation Department	5.24	6.44	4.71
2.5.4 – Has invested in technology to produce new products or improve processes	5.76	6.44	6.29
2.5.5 – Leads its supply chain, involving suppliers	4.6	4.88	5.00
2.5.6 – Collaborates in innovation with customers and suppliers	5.18	5.88	5.50
2.5.7 – Uses external sources of knowledge (suppliers, customers, competitors, consultants...)	5.49	6.31	5.57
2.5.8 – Collaborates in the introduction of technological or organisational innovations in its vendor network	4.22	4.31	4.86
2.5.9 – Leads diversification into new products and markets	4.44	4.94	4.71
2.5.10 – Participates in projects with other knowledge centres	4.29	5.75	4.71
2.5.11 – Carries out innovation projects in collaboration with other organisations	4.49	6.13	4.86
2.5.12 – Participates in public-private partnership projects	3.84	4.75	4.14
2.5.13 – R&D&I are financed by public aid	2.84	4.56	3.86
2.5.14 – Leads business co-operation networks in its own sector	3.76	4.38	3.71
2.5.15 – Measures innovation results	4.6	6.00	4.57
2.5.16 – Has registered patents or utility models (or is in the process)	3.4	4.19	2.71
2.5.17 – Has made payments for technology licenses	3.07	4.31	3.57

Table 7. Comparative analysis of average ratings between provinces

CONCLUSIONS

A series of conclusions, separated into two sections, can be drawn from this work:

- There are a significant number of pull companies in the province of Castellon, as well as in Alicante and Valencia.
- A comparison of absolute values obtained from this population of pull companies and the whole set of companies in the *Valencia Region* (hereinafter, CV) reveals the highest degree of innovation depends clearly on the size of the company, as was noted in the other studies cited above.
- Pull companies in Castellon:
 - The source of what they market is basically CV.
 - They purchase in CV (70% of procurement is from CV).
 - The reasons why they do not buy more from CV are mainly due to the absence of suitable suppliers.
 - These pull companies' experience in INNOVATION is basically distributed:
 - Investment in technology to produce new products or improve processes (5.76 out of 7).
 - Use of external sources of knowledge (5.49 out of 7).
 - Collaboration with customers and suppliers (5.8 out of 7).
 - Existence of an Innovation department (5.24 out of 7).
 - The 3 different sizes studied do not influence Innovation practices. The results are similar in all 3 groups.
 - Vendors supplying these pull companies that come from the CV are competitive in quality, prices and innovation capacity. The study shows that the search for suppliers outside the CV is mostly due to a need for more exclusive products.
 - Collaboration and innovation links are set up in the chain. They also use external sources of knowledge.
 - This figure grows the higher the amount of procurement from CV (customer-supplier relations).
 - Pull companies that sell to industrial or service companies (B2B) mostly have a defined innovation strategy and implement it to a greater degree than those that do not sell to these sectors.
 - The same happens with having an Innovation Department and with participating in joint projects with Knowledge Centres.
 - Pull companies with the highest degree of Innovation collaborate to a greater extent with their suppliers, introducing technological innovations that enable them both to grow.
 - An intermediate use of R&D&I projects financed with the participation of public aid is seen.
 - Pull companies in the ceramic cluster license and/or patent their innovations to a small extent, unlike other companies in other clusters.
 - This distribution coincides with other papers (mentioned above) on the distribution of innovative companies.
 - These data confirm a puller-innovative company tandem.

- Over the years, they have created external economies and their own institutional frameworks, networks of relationships, information and knowledge networks, etc. typical of what is known as a Cluster.
 - It can be concluded that pull companies consolidate territories pre-constituted as dynamic in Innovation and that they are instrumental to generating wealth.
 - The results obtained here match those in the research papers consulted.
 - Valencian companies are mostly declared innovative (75% according to the study by J. Salom, J.M. Albertos, M. D. Pitarch and E. Delios "*Sistema urbano e innovación industrial en el País Valenciano (Urban system and industrial innovation in the Valencia Region)*").
 - Most innovations are process innovations (65%).
 - Generic machinery modernising is the most cited process innovation (41%).
 - In most cases, the initial idea of the innovation is born inside the firm itself (64%).
 - The authors segregate companies that declare themselves innovative as:
 - Leaders (15%).
 - Receptive to innovation (40%).
 - Passive (45%).
 - These data coincide in a general manner with other even more recent publications ("*Innovación y desempeño económico en la empresa valenciana (Innovation and economic performance in the Valencia Region)*" Isidre March).
 - Pull companies and generally the largest-sized firms outsource part of the production process (even with more vertical than horizontal links).
 - On the basis of these results, it is clear that the presence of pull companies bring reinforcement to a territory in its business structure and makes it more dynamic towards innovation, with the consequent benefit for all the actors involved.
 - This corroborates the importance that constituting clusters has on innovation, both overall and in individual companies (whether pullers or suppliers).
 - It should be noted that since last year (2020-2021), a number of mergers and acquisitions have taken place between companies in the cluster who may belong to the group classified as pull companies. Such actions result in inorganic growth and, therefore, as a result of the study, an increase in their 'towing' capacity can be expected.
- That is why this study is under review to see how the phenomenon of mergers and acquisitions is affecting companies' 'towing' capability and, by extension, the relational capital.

IN ONE SENTENCE:

By way of a highly synthesised summary in one sentence (albeit simplistic), the following can be stated:

Pull companies in Castellon, and basically those in the ceramic cluster of Castellon, are mainly industrial, they purchase mostly from suppliers in the Valencia Region, they are innovative in the way they incorporate technology and participate in joint projects with their suppliers and knowledge centres, and thus they demonstrate a clear "pull effect" on procurement and innovation.

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- [10] "La Innovación territorial y el empleo en la Comunidad Valenciana". Universitat de València 2020. Work coordinated by Jorge Hermosilla.
- [11] **NOTE:** This study has drawn information from the study conducted by the Business Innovation Centre (BIC) in the Valencia Region, funded by Valencian Institute for Business Competitiveness (IVACE): "Informe Empresas tractoras 2020 Comunitat Valenciana" available at www.emprenemjunts.es