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Additional Information

## *The dynamics of cluster entrepreneurship: knowledge legacy from parents or agglomeration effects? The case of the Castellon ceramic tile district*

**Abstract:** What are the main mechanisms driving the process of industry clustering? There is a tension between two different perspectives as regards explaining entrepreneurship and spatial concentration: the roles played by agglomeration economies and knowledge legacies passed on from parents to spawns or spinoffs. Using qualitative interviews and archival data analysis, this paper tracks the evolution and the organizational reproduction of the ceramic tile cluster of Castellon (Spain) since its inception in 1727. Results show the existence of agglomeration and socially-based *co-operation* forces. Beyond *de novo* spinoffs, abundant social capital in highly agglomerated regions facilitates co-operation and new firm formation, and even co-operation amongst competitors to create new firms. Socially-based networks, reinforced by agglomeration externalities, all act as learning mechanisms to build pre-entry capabilities in new ventures, complementing Klepper's inheritance perspective. Spatial concentration of an industry can be attributed to the benefits of agglomeration and socially-based co-operation, in combination with the influence of knowledge legacies in a complementary and synergistic process. Conclusions are framed within the knowledge spillover theory of entrepreneurship, shedding light on *how* entrepreneurship occurs in clusters.

**Keywords:** industrial dynamics; industrial districts; spin-offs; agglomeration; KSTE; networks; cluster evolution

### **1 Introduction**

Spinoffs are considered of utmost importance for the development (Garvin, 1983; Agarwal et al., 2004; Chatterji, 2009) and spatial concentration (e.g. Dorfman, 1983; Kenney and von Burg 1999; Klepper 2007) of industries. The entrepreneurial phenomenon of industry clustering from new venture formation and the subsequent cluster<sup>1</sup> evolution, which constitutes the purpose of this study, has received increased attention by industry economists and strategists (e.g. Cheyre, Klepper and Veloso, 2015; Wang, Madhok and Li, 2014; Klepper, 2011; Klepper, 2010; Buenstorf and Klepper, 2009; Klepper, 2007) and from economic geographers (e.g. Cusmano et al., 2015; Costa and Baptista, 2012; Boschma and Wenting, 2007; Scott, 2006; Stuart and Sorenson, 2003; Sorenson and Audia, 2000; Phelps, 1992).

Addressing spinoffs, two different yet intertwined perspectives claim to explain cluster formation and evolution through entrepreneurship or new firm formation: the influence of the knowledge legacies of the parents of entrepreneurial spinoffs (new independent firms, the founders of which worked previously in the same industry, inheritance approach) and the effects of agglomeration or externalities. This unresolved tension calls

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<sup>1</sup> The terms industrial district, industrial cluster, cluster, district, geographical agglomeration, and agglomeration can be used interchangeably throughout the paper, although we recognize that some differences remain and our focus is based on Marshallian industrial districts (MIDs).

for further empirical research. Literature has explained the evolution of industries through spinoff formation, explaining the *nature* of spinoffs, the *reasons* why their founders leave incumbent firms and spinoff *performance* (e.g. Agarwal et al., 2004; Klepper and Sleeper, 2005; Franco and Filson, 2006). This perspective has stressed incumbent-to-progeny capability transmission through an inheritance process by emphasizing an incumbent's capabilities and its role influencing spinoff formation and performance. Capability transfer and inheritance process from incumbents (parents) to spinoffs (progenies), however, has argued that the effects of agglomeration only play a minor role in industrial spatial concentration because *spillovers are confined to parents and their spinoffs and do not extend across co-located firms in general* (Buenstorf and Klepper, 2009:730). In fact, this perspective allocates more importance to the influence of spinoffs' internal knowledge inherited from parents at the time of entry, while agglomerations are only considered to be of minor significance<sup>2</sup>. This view asserts that the spinoffs inherit competencies from their experienced parents, which enables them to outperform other firms, minimizing the role of inter-firm relations.

Inter-firm relations or interactions, however, constitute additional learning mechanisms to access to knowledge, as the *relational view* (Dyer and Singh, 1998) and the *network approach* (Powell et al., 1996) have argued. In this line of thought, from the economics perspective, Marshall, Arrow and Romer (MAR) externalities (e.g. Glaeser *et al.*, 1992), on the one hand, are economies of scale external to the firm but internal to a territorial system, facilitating agglomeration, due to the advantages of localisation, such as production costs reduction, access to specialised inputs and suppliers and the better access to learning due to the presence of knowledge or technology spillovers (e.g. Audretsch and Feldman, 1996; Klepper, 2011). MAR focuses on knowledge spillovers between firms in the same industry. Related to this idea of externalities, this study focuses on the specific, distinct social structure of geographic concentration or Marshallian approach to industrial districts (MID). The industrial district literature (MID), on the other hand, points out the *social dimension* (e.g., Becattini, 1979, 1990; Brusco, 1982; Piore and Sabel, 1984; Belussi and Hervas-Oliver, 2017) of agglomerations. Social ties, reinforced by continuous interactions reduce transaction costs and favour knowledge exchange, facilitating a model of network-based and flexible specialisation of production fuelled by subcontracting, fostering the co-existence of competition and co-operation that positively

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<sup>2</sup> Klepper (2007: 629), however, recognizes the potential role of agglomeration in cluster formation.

impacts innovation (e.g. Camagni, 1991; Belussi and Sedita, 2009). Specifically, industrial districts are socio-territorial entities which feature an active presence of both a community of people and a population of firms in one naturally and historically bounded area (Becattini, 1990). Within this MID perspective, it is said that higher founding rates are leveraged on the occurrence of dense local concentrations, meaning that entrepreneurship occurs within, and from out of, specific existing spatial and social structures: spinoff entrepreneurs learn the trade from existing cluster incumbents or social structures and not only from parents (Brusco, 1982; Sorenson and Audia, 2000; Stuart and Sorenson, 2003; Dahl and Sorenson, 2014), to the extent that in MIDs new ventures have social capital before entry (Sorenson and Audia, 2000). In other words, knowledge inherited from parents is not the only way for new ventures in clusters to learn (cf. Saxenian, 1994; Cusmano et al., 2015): inter-firm relationships are powerful learning mechanisms, shifting the focal point from inheritance to inter-firm interactions and knowledge spillovers as capability-building constituents (e.g. Marshall, 1920; Glaeser et al., 1992; Audretsch and Feldman, 1996), even capable of contributing to spinoff generation (e.g. Saxenian, 1994; Stuart and Sorenson, 2003). This MID perspective is also reinforced from strategy literature which, emphasizing the relational approach, explicitly recognizes that agglomerations lie behind the entrance of new firms (e.g. Kalnins and Chung, 2004; Alcacer and Chung, 2007; De Figueiredo et al., 2013; Wang et al., 2014; Alcacer and Chung, 2014).

Such inconclusive tension between the two perspectives fragments theory and prevents the advance of knowledge in the topic. This article disentangles that tension and attempts to conciliate those perspectives within a comprehensive and integrative entrepreneurial framework, utilising the emergent perspective focused on the *knowledge spillover theory of entrepreneurship* (KSTE<sup>3</sup>, e.g. Agarwal et al., 2010) as theoretical connector of both inheritance and agglomerations mechanisms. KSTE addresses both perspectives and explains, on the one hand, those sources of opportunities fostered by entrepreneurs, based on the utilisation of underexploited knowledge created by others (Agarwal et al., 2004; 2007; 2010; Acs et al., 2009), pointing out that founders' past industry experience matters for both the creation and performance of new ventures resembling the inheritance approach. KSTE argues, on the other hand, that context matters for entrepreneurship and,

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<sup>3</sup> Audretsch, Acs and other seminal authors adhere to this emergent theory.

specifically, *localisation* influences and shapes new venture creation, due to the fact that knowledge spillover in KSTE relates to knowledge flows that are un- or undercompensated (Agarwal et al., 2010:272-273), resembling the agglomeration view. Intersecting the combination of the inheritance and the agglomerations approach, KSTE sheds light on *how* entrepreneurship occurs in clusters and how entrepreneurship fosters spatial concentration of industries.

We posit that externalities from agglomerations and socially-based co-operation, as additional to inheritance, both constitute a potential complementary explanation of *why* and *how* spinoffs emerge, build their pre-entry and initial capabilities and foster industry concentration and subsequent cluster formation: entrepreneurs, as well as learning from incumbents' capabilities, also depend on context and activate networks of relationships in order to assemble resources and build their business model during the startup process. In this line of thought, we argue that in MIDs mechanisms fostering learning and capability building at pre-entry and at the time of spinoff founding are constructed by both the incumbents' knowledge transfer (inheritance) and learning from localisation and social networking (agglomeration and socially-based co-operation) in a complementary and synergistic self-reinforcing process. The rationale of our *relational* argumentation is sustained on the basis that the locus of innovation and learning in clusters is found in *inter-organisational networks* (Powell et al., 1996:142; Saxenian, 1994; Uzzi, 1997; Sorenson and Audia, 2000), stressing the importance of relationships in order to explain why geographical areas facilitate spinoff creation. In fact, as Chatterji (2009) posits, superior spinoff performance is not driven only by technological spillovers from parent to spawn.

While past research has focused on assessing the impact of industry experience (e.g. Chatterji, 2009), or the influence of industry incumbents (e.g. Agarwal et al., 2004) on spinoff performance and how a knowledge legacy from parents to spawns explains spatial industry clustering (e.g. Klepper 2007), we leave spinoff performance and survival rates analysis to others. Our study focuses on disentangling the process of new firm formation in clusters and *how* each perspective, parents' knowledge legacies and agglomeration, shapes the entrepreneurial process in a spatial context. Specifically, we ask: what are the mechanisms at work in the process of the creation of new firms and cluster evolution? For this, we seek to understand the learning mechanisms of new ventures at the time of

their entry into clusters, considering both the effects of parents' legacies and that of agglomeration. Considering Gigerenzer's (1991) thesis of the non-neutrality of scientific tools associated with thinking and theory crafting, we leave survival rates analysis to others. Agglomeration mechanisms and their complex nuances are not easily grasped by simply measuring entry and exit rates. Rather, we engage in theory-building (Eisenhardt, 1989; Eisenhardt and Graebner, 2007) by utilising longitudinal case study research on the evolution of a cluster. Our study and method are both justified by the fact that although we observe that spinoffs in clusters are ubiquitous, yet the vast empirical literature in fact ignores the process of *how* those new ventures have learnt at the time of entry.

We separate study of the mechanisms at work in the process of new firm formation in clusters from that of studying new venture performance because, following Stuart and Sorenson (2003), social ties that enable entrepreneurship and spatial concentration do not necessarily promote a better performance from new firms, due to the increased competition in agglomerations. We posit that in addition to the effects of a parent's knowledge legacy, inter-firm and interpersonal social networks, i.e. MID externalities, are also key learning mechanisms for new ventures before entering. Agglomeration, therefore, favours a higher founding rate for new entrants in clusters and complements inheritance, extending KSTE. In addition, the spinoff formation process, different from that of knowledge legacies remarked in Klepper's studies, also follows a patterns characterized by parent-backed and collaborative new ventures. The latter is really novel and important for the literature, especially because those forms of entrepreneurship contribute to the understanding of vertical disintegration and the intense division of labour in MIDs.

In our study, the focal process is the mechanisms at work in cluster formation and evolution through entrepreneurship, and the setting is the Castellon<sup>4</sup> ceramic tile MID in Spain since its inception during the early eighteenth century up until 2010. The Castellon cluster has been labelled a Marshallian industrial district (Hervas-Oliver and Albors-Garrigos, 2009). This characteristic makes the Castellon case different from the types of clusters typically analysed through the inheritance perspective, and this, along with our

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<sup>4</sup> The importance of the Castellon cluster is supported by its citation in Porter's (1990:298-299) seminal work, which recognizes it as a key competitor against Sassuolo, an Italian ceramic tile cluster. Today, Castellon is a world-class ceramic tile pole.

access to a unique longitudinal database, makes this Marshallian industrial district well suited to our purpose.

Our study contributes to entrepreneurship by connecting the specific case of entrepreneurship in industrial districts and their spatial and social context into the knowledge spillover theory of entrepreneurship (KSTE). Our study's results highlight and extend two important components of KSTE perspective (e.g. Agarwal et al., 2007; 2010; Acs et al., 2009; Audretsch and Lehmann, 2005) and its application to clusters: the *localized context* and its related externalities from agglomeration, socially-based co-operation and the effect of *founders' past industry experience*, all shaping new venture creation in a complementary and synergistic way, supporting the emerging KTSE as a regional model of entrepreneurship (Plummer and Acs, 2014). In doing so, this study extends KSTE by addressing the still missing inter-firm level (Shu et al., 2014). Furthermore, this study also sheds light on the emphasis of context in entrepreneurship (Tan, 2006; Jack and Anderson, 2002). All in all, this study contributes to entrepreneurship and cluster literature by providing novel evidence of how agglomeration, socially-based co-operation and parents' knowledge legacy mechanisms interplay to shape cluster evolution. Our results serve to enrich the economic geography, innovation and entrepreneurship literatures, disentangling and conciliating that inconclusive topic based on two differing perspectives.

The paper is organized as follows. After this introduction, Section two presents a review of the literature and theory. Then, Section three presents the ceramic tile district of Castellon. Section four presents methods, including empirical design, data sources and data analysis. The latter addresses a brief and synthetic part showing the history of cluster evolution in order to contextualise, obtained from archival data analysis, and another part based on the qualitative analysis of data from interviews, discussing results. Finally, Section five concludes the study, highlighting the most significant contributions it makes to the literature.

### **3 The Castellon ceramic tile district: an introduction**

Spain is a leading country in tile production. The Castellon ceramics tile district in Spain includes all the activities of the ceramic tile value chain, as well as various public R&D organisations such as the Institute of Ceramic Technology (ITC-ALICER, hereafter),

educational centres (including, for example, the Jaume I Universitat), and private institutions such as trade associations (including *Ascer*, *Anffecc*, and *Asebec*) (Hervas-Oliver and Albors-Garrigos, 2007, 2009). The ceramic tile industry in the cluster provides 14,300 direct jobs (in 2014), and encompasses around 200 firms<sup>5</sup> plus 100 auxiliary firms (in glazing and equipment), concentrating around 90% of Spanish and 45% of European production. The main activities consist of: the manufacture of equipment for tiles, production of ceramic tiles, frits and glazing processes (tile decoration), clay grinding, distribution, logistics, R&D activities (public and private), and training (in a university, vocational training centres, and other institutions). The main locations of the cluster are to be found (but not limited to) districts and towns around Castellon, namely *l'Alcora*, *Onda* and *Villareal*, covering around 20 square kilometres. Within the cluster, frits and glazing processing is the most important of the auxiliary industries (Meyer-Stamer et al., 2004; Hervas-Oliver and Albors-Garrigos, 2007). The Castellon glazing industry is the world leader with 26 firms exporting around 66% of their total production and representing 70% of the world's exports; and employing around 3,200 workers in 2014 (Anffecc, 2014). A key competitor is the Sassuolo (Italy) cluster, responsible for 40% of European production.

#### **4. Data sources, methods and contextualization**

For our research we have used the approach of a case study, a key instrument for gathering complex information (e.g., Eisenhardt, 1989; Eisenhardt and Graebner, 2007), with secondary data analysis being utilised alongside in-depth semi-structured interviews. Following Eisenhardt and Graebner (2007), theory-building research using cases typically answers research questions that address “how” and “why” in unexplored research areas. Our research achieved triangulation of data by posing specific questions to interviewees, engaging in discussion with experts in the industry and policy makers, and also by comparing results with secondary data, following Baxter and Eyles's (1997) recommendations. This approach is also consistent with Yin (2008). The research setting is the Castellon ceramic tile MID, its evolution and entrepreneurship process since its inception in 1727, with special emphasis during the second part of the 20<sup>th</sup> Century where data is richer. The focal process is new firm formation and its learning mechanisms. In particular, we focused on learning processes and mechanisms that firms considered

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<sup>5</sup> Retrieved from [www.ascer.es](http://www.ascer.es) (March, 2011th)



relevant for their ventures at the time of entry into the industry and territory. Our research goes a step further and analyses different types of spinoffs (that is to say, *de novo* and also corporate-parent new ventures), following Helfat and Lieberman's (2002) classification.

#### **4.1 Data sources**

We identified all active firms from rosters provided by industry associations (Ascer and Anffecc). The primary content of this study is based on the ceramic tile firms which constitute the core of the district. Indirectly, we also studied firms in other related industries (atomizers, frits, etc.) when ceramic tile firms spawned them or participated in their creation, in so much as we could also trace the vertical disintegration in the district. All in all, 167 firms were explored in-depth, using archival data and interviews.

135 are ceramic tile firms, from which 25 firms were created before the 60s. Amongst these firms, 20 ceramic tiles were analysed just by using archival data from the Museums and other historical reports. Afterwards, 5 ceramic tiles created during the 60s and 110 created during the following decades were all analysed mainly through interviews with the informants, although we triangulated data with secondary sources. Furthermore, 32 firms analysed were frits and atomizers, being mainly created by ceramic tile firms since the 70s. In total, the 135 ceramic tile firms represent 54% of the total entrants during the 20<sup>th</sup> Century (249 total entrants, 140 active in 2010). More related data is offered below in tables 2a and 2b.

With the interviews and secondary data our exploration process goes further than just the informants and their firms at the time of their constitution by tracking all their ancestors (parent firms) and the root of their genealogies, along with their potential spawns alike. For those 167 firms we worked with a total of 81 informants. In addition, some of the interviews were with key informants from the trade associations (ASCER or ANFFECC) but they were also founders or CEOs of local firms in tile related industries. N.B, some informants were parents that started many parent-based spinoffs, so the same informant described the whole genealogy of the family firms<sup>6</sup>.

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<sup>6</sup> It was frequently the case that, during interviews with companies, respondents would spontaneously mention the progenies their firms had spawned. From some historical data we were also able to identify entries going back to the eighteenth and early nineteenth centuries.

Our study relies on several data sources including: (1) qualitative data from semi-structured interviews; (2) emails, phone calls, informal meetings, visits to the ceramic tile fair trade in Castellon and follow-up interviews to track new firm formation; (3) archival data, including corporate documents and annual reports, along with three key archival sources that revealed who the founders of the firms were, and which were, if any, the parent companies. These included: *La industria de la ceramica en Onda: 1778-1997*<sup>7</sup>, a publication of the ceramic museums of Onda, and the best source for tracking firms and their founders; and *La industria ceramica de la plana de Castello*, written by Membrado (2001). These two publications are publicly available. The third archival source was an Ascer (ceramic tile trade association) internal report that provides entry and exit data for ceramic firms in Spain<sup>8</sup>. (4) Lastly, the SABI database<sup>9</sup> was also helpful for analysing shareholders in spawns which were active firms at the time of analysis, complemented by archival data from the commercial register when necessary.

The primary data source was 60- to 120-minute, semi-structured interviews. With firm-level informants, we focused on the company's foundation history and the learning mechanisms at those times. Interviewed respondents (81) included: managers and ex-managers (retired) of leading firms; industry association representatives in the cluster; and the managers of the two key ceramic tile museums (Onda and L'Alcora) in the cluster, who provided excellent retrospective accounts. The same person could be interviewed twice or three times for purposes of data triangulation, over periods ranging from one to three hours. Interviews were conducted over the years 2012, 2013 and 2014. Each interview consisted of two main parts: (1) the asking of general questions related to the collection of background information about the setting up of the firm, asking about potential disagreements, parents' co-operation, family connections, and other matters; (2) the asking of direct questions related to the learning mechanism at the time of entry, directed to both parents and spawn alike.

As regards chronology, we asked open questions that focused on entry experiences and learning mechanisms at the time of each firm's foundation (e.g., "*What did you learn*

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<sup>7</sup> <http://www.museoazulejo.org/es/publicaciones.php#>

<sup>8</sup> We thank Michel Toumi, Ascer manager, for access to the data in this report.

<sup>9</sup> SABI is the Spanish version of Bureau Van Dijk; <https://sabi.bvdinfo.com/version-2015323/home.serv?product=sabineo>

*from your parents (employers) before starting up your own venture? How important were your parents' networks for starting up? How much knowledge did you gain from your personal social ties before starting up? Did you cooperate with your parents after launching your own venture? At the time of formation, how important was it to locate there in the cluster, and why? How important, if any, were your parent company's family ties in your venture's formation?"). We then reviewed the chronology of the new venture creation. Lastly, in order to provide a stronger grounding of theoretical insights (Eisenhardt, 1989), we conducted interviews with direct questions related to both mechanisms such as "Did all your knowledge come from your ex-employers? And, Do you think that agglomerations matter in relation to new firm formation in this cluster?"*

#### **4.2 Contextualization: setting the historical evolution.**

The inception of the cluster with a first wave of entrepreneurial activity occurred in the early eighteenth century. In 1727 the Earl of Aranda (*Conde de Aranda*) was commissioned by the Spanish king Philip V (*Felipe V*) to establish the *Royal Ceramic Factory of Alcora (Real Fábrica de Alcora*<sup>10</sup>). This company was active up until 1936<sup>11</sup>. The Earl of Aranda commissioned French ceramic masters to help with the start up. Alcora was chosen as a location because of its already established Arab ceramic tradition, and because of the large presence of good quality red clay quarries. The Alcora industry was mainly dedicated to producing ceramic tableware products and artisanal tiles, based on the use of an Arab kiln tradition. At that time, 24 Arab kilns for making ceramic tableware and artisanal tiles were operating (Gomis, 1990). In the mid nineteenth century technicians from Staffordshire, United Kingdom, were also brought to Castellon (Ortells, 2005). Therefore, although the first stages were marked by spin-offs and organizational reproduction triggered by the establishment of the Royal Ceramics Factory<sup>12</sup>, agglomeration was also playing an important role, attracting the Royal Ceramic Factory (RCF) in the first place. Up until the Second World War, the incipient agglomeration continued to evolve, based on craftsmanship and Arabic kilns. However, it was not until

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<sup>10</sup> All Royal Factories were managed by the Spanish Army and its engineers.

<sup>11</sup> <http://www.lalcora.es/es/content/historia-ceramica>

<sup>12</sup> In the late eighteenth century the first spinoffs from the RCF occurred: in 1778 the firm Guinot (founded by Guino, with Mariano Jacinto and Juan Bautista, all RCF ex-employees) (Franch, UJI Doctoral Thesis); in 1780 a second spinoff founded by the French artisan (but located in Castellon) *Joseph Ferrer*, which later spawned others, such as *Azulejos Mijares*. Then, in 1827 came *La Camapana*, in 1852 *El Leon*, in 1857 *La Valenciana*, and then *La Esperanza* (Ortells Chabrera, *Treball Societat Catalana Geografia*, 58, 2005, pp.41).

the 1950-1960 period that the cluster had enough technical capabilities and a sufficient critical mass (49 companies in 1953 and 138 in 1969, rising later to 200 by 1999; Membrado 2001) to be considered a cluster as such, involving extensive relationships. See figure 1 for new firm entries per year for the 1900-2012 period (Ascer internal report: data for entries).

### **Insert figure 1 here**

As predicted by the literature, an important boost to the cluster's beginnings was the entrance of a diversifier (The Royal Ceramic Factory, a branch of the Spanish Army), which acted as a training centre and a source of spin-offs<sup>13</sup> (Coll, 2009). These pioneering spin-offs also themselves spawned new companies<sup>14</sup>. A pattern of persistent family ties is present throughout the whole timeline of the cluster's evolution, supported by the fact that all controlling families have been locally embedded entrepreneurs. The pattern of evolution described relates to Alcora and Onda. Another source of spin-offs was the Regional Ceramics School (*Escuela Provincial de Ceramica*). This training school was an important institution and a major source of new spin-offs during the decade prior to its closure at the time of the Spanish Civil War (in 1936). As a measure of the school's importance, it can be noted that it was a crucial player in the establishment in Onda of 30 workshops in 1929, all spinoffs from the Ceramics School, while Alcora (the original location of the Royal Ceramics Factory) only saw 6 spinoffs in that year. Below, we describe events in successive post-war periods.

#### **The 1950s.**

In Villareal, the ceramics industry was absent until the 1950s. Villareal is the place where the cluster consolidated and was the location for the most radical innovations generated during the second half of the 20<sup>th</sup> century. During the 1950s Villareal began to gain importance thanks to the entrance of new diversifiers. These incomers had industrial (rather than artisanal) orientations. Meanwhile, in Alcora and Onda the use of old, small workshops continued. In the early 1950s old ceramic factories (some of them with direct links to the *mother* Royal Ceramic Factory) co-existed with diversifiers from the orange industry;<sup>15</sup> (Castellon has been a leading orange production centre in Spain for the last

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<sup>13</sup> For example, spin-offs included: La Primitiva, in 1857; La Campana, in 1827; and La Glorieta, founded in 1848.

<sup>14</sup> For instance, *La Glorieta* (1848-1966) spawned *El Siglo* in 1897 (surviving up until 1997). *El Siglo* in turn spawned *El Molino* (in 1922), a currently active firm (we interviewed the fifth generation of owners from the same original family in Cevisama Ceramic Fair Trade, 2012).

<sup>15</sup> In the early 1950s several unusual snowfalls froze the orange crops and companies in that field started to look for alternatives in other industries, such as ceramic tiles.

two centuries), from the furniture industry (local firms producing baskets for the oranges), and from the local construction industry, as well as from other local industries. These entrants, all local entrepreneurs with extensive access to local information and knowledge, subsequently produced successful spin-offs

### **The 1960s and 1970s.**

There was a new wave of spin-offs in the late 1960s, mainly due to the introduction of radical, new technology which served to separate the firing process into two steps: first, the firing of the clay; and, second, the decoration, that is to say the application of frits and glazes to the fired clay surface. Beyond *de novo* spinoffs, in-depth interviews showed very interesting examples of co-operation agreements between existing competitors in order to found new ventures.

### **The late 1970s and 1980s.**

In the late 1970s and during the 1980s the technology used in ceramic tile firms transited from the twice-fired to the single-fired process (*monocottura*, invented by Marazzi<sup>16</sup>). This was one of the most important radical innovations in the cluster and triggered the establishment of many new firms. To begin with, the single-fired process was developed for floor tiles, but then the same technology was developed for making wall tiles. The main actors in the development of the technology were the leading Italian ceramic tile equipment company (Sacmi) and local, leading Castellon firms acting in alliances (including Porcelanosa, Zirconio, and Natucersa, among others). The new single-fired process required new frits (to be fired together with the clay in conjunction), different processes, and new atomizers (new clay grinding processes for the single-fired process, named wet grinding). A wave of new companies appeared, mainly frits and glazing firms and atomizers. Some new firms were multinational companies attracted from other ceramic tile clusters,<sup>17</sup> drawn in by the single-fire technology and its new decorative capabilities. Most of the new glazing companies were spawned by incumbent ceramic tile firms, founded either as a spin-off backed by a single parent<sup>18</sup> or as one backed by a number of cooperating local parent firms<sup>19</sup>. Thus there were either single parent spinoffs

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<sup>16</sup> Cusmano et al., (2015)

<sup>17</sup> Colorobbia arrived in 1988 from Florence and Sassuolo, in Italy, and Johnson Matthey Ceramics came in 1990, from the Stoke-on-Trent ceramics cluster in the United Kingdom.

<sup>18</sup> For instance *A la Plana* spawned *Vidres*.

<sup>19</sup> For instance, *Keraben* and *Wendel* spawned *Kerafrit*. *Porcelanosa* and *Ferro* together spawned *Esmalglass*.

or parent-company joint venture spinoffs, while others were spin-offs spawned by frits firms<sup>20</sup>. The new atomizers for the single-fired process<sup>21</sup> were again firms spawned by local competitors acting in co-operation, i.e., parent-company joint ventures, collaborating in order to keep up with radical innovations.

Later on during the 1990s and the 2000s the process of the founding of spin-offs and the entrance of new ventures continued. In table 1 below, a summary of the main results of the historical process and major technological events are presented.

**Table 1 here**

## **5 Data analysis: mechanisms at work in the process of cluster formation and evolution in the Castellon MID**

### **5.1 Archival data analysis**

Overall, and according to the analysis of archival data, we herewith present the following findings:

#### **Insert table 2a here**

First, according to table 2a, 320 firms<sup>22</sup> entered the Spanish ceramic tile industry during the 20<sup>th</sup> Century. Interestingly, around 77% of the new ventures were concentrated in the Castellon province, basically around Alcora, Onda and Villareal, while the rest of the new ventures were scattered all around Spain. Castellon registered a total of 249 firms out of 320 in the ceramic tile industry. These figures do not account for frits or atomizers. In addition, in 1929, according to Onda Museum data, before the Civil War, 49 firms were identified in Onda, all of them entering during the late XIX Century and not registered by ASCER. The final figures, therefore, could be even higher and show a higher concentration. The highest entrance in Castellon started during the 50s (50s: 17; 60s: 28; 70s: 39; 80s: 56) and showed a peak in the 90s (87). See table 2a. In terms of net creation of ceramic tile firms (entrance minus exits), according to table 2b, it is clearly shown how most firms created survived up to the late 90s. Later, especially in the 2000s (also reflected in figure 1), there was a total net variation of minus 77 firms, due mainly to the

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<sup>20</sup> For instance, *Fritta* spawned *Coloronda*

<sup>21</sup> *Atomizadora* was spawned by *Peronda*, *Gaya Fores*, *Azulindus* and *Novogres*. *Atomix* was spawned by *Aparici*, *Gaya* and *Tau*. *Tierra Atomizada* was spawned by *Cerpa*, *Rocersa* and *Quimicer*.

<sup>22</sup> Total population registered by ASCER in its historical archives for the 20<sup>th</sup> Century only for ceramic tiles. Nevertheless, starting from the XIX Century, 49 firms existed in 1929, just before the Civil War.

bursting of the real estate bubble in Spain<sup>23</sup> and the Great Recession in Europe. Despite that manifest destruction of firms, Castellon, in net terms still has the highest concentration of the industry in Spain, 73.68% of all remaining firms. See table 2b

**Insert table 2b here**

Overall, this result indicates one interesting finding: Castellon's cluster does present objective advantages. Put differently: agglomeration effects existed, as new ventures were primarily attracted there. This is one important idea not evidenced in Klepper's works.

**Insert table 3 here**

Second, we have estimated that parent-backed or collaborative (joint venture) forms are the majority (around 61% of the sample) and family ties account for almost 40% of the sample, basically within those parent-spinoffs. In table 3 we observe how the proliferation of parent company joint ventures (CPJV) occurred mainly during the hard times of external shocks, such as after the Civil War (two CPJV, *Tiles* and *Realonda* in the 50s) and that of disruptions (transition to twice-fired and single-fired technological disruptions, late 60s up to early 80s). In particular, we documented 3 CPJV in the 60s, 6 in the 70s and 4 in the early 80s: these newly created CPJV were made up of co-operation agreements amongst competitors, focused on surviving the new environments. Afterwards, in table 3, it is also shown how parent-spinoffs also followed a similar pattern (60s: 10; 70s: 23; 80s: 28). These parent-spinoffs have been pervasively found, but they were especially relevant during those technological transitions. During technological changes, technological heterogeneity clearly offers more opportunities to be taken advantage of by creating new ventures in order to cover different products or production techniques. Similarly, other different types of new entrants (diversifiers, de novo spinoffs, startups) were also pervasively encountered throughout the period. In total, from our sample of 167 firms, 61.7% of those new ventures were somewhat parent-backed ones and 38.3% were the conventional ones (de novo, startups, etc.). Amongst all of them, the parent-spinoff is the most frequent type of new venture created in the Castellon cluster. CPJV accounted for 9% of the total figure and it is a type of new entrant that has not been encountered again during the 90s and 2000s. See table 3.

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<sup>23</sup> It is worth noticing that ceramic tiles manufacturers mainly work for the construction industry, which has almost disappeared since 2007 due to the bursting of the real estate bubble suffered in Spain.

## 5.2 Parent-backed ventures: who are they?

Parent-backed ventures, those parent-spinoffs and CPJV, are a direct consequence of the pervasive social ties and co-operation in the district. In the specific case of parent-spinoffs, on the one hand, family ties, strong social ties, among others, are very interesting elements facilitating two main strategies. (i) Creation of new ventures by founders that continue also as owners (usually partial ownership) in other companies (in the parent company), thus forming groups of firms that are connected by sharing the same founders and/or managers. This guarantees the direct or indirect transfer of knowledge from one company to the other. Moreover, the networks of suppliers and other contacts are easily brought to the new firm because this one has direct access to the reputation and trust offered by the founder or parent. In this case, the firms are not competing ones, because the new ones are usually created to deal with other products or segments or just as subcontractors of the parent firm. Existing networks orchestrated by leading firms (in this case, parents) are vital for ID functioning, in so far as they provide legitimacy to access tacit knowledge (Scott, 1992:16). (ii) Creation of new ventures in which the parent firm family members are transferred to manage (and partially own) the new venture: in this case, the parent company has a % of stake in the new one, and the new one deals with or focuses on other products or segments or is also used for outsourcing processes. In both cases the component “family” is intense and it guarantees exchange of knowledge and supports itself. Besides, as the *Porcelanosa* managers outlined, these family groups were also designed to minimize knowledge spillovers outside the groups and thus favour knowledge circulation just within the family.

One example of a parent-spinoff company is one observed in Villareal. The founders of Azu-Vi also founded the spin-off Zirconio<sup>24</sup> on an amicable and agreed basis, for extending the product range. This was a *parent-backed spin-off*. Moreover, both companies, Azu-Vi and Zirconio co-operated ex-post the new firm’s creation over many years. Therefore, Porcelanosa<sup>25</sup> included amongst its founders Mr. Soriano (one of the

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<sup>24</sup> The founders were also founders of Azu-Vi, along with an engineer, Mr. Pitarc, and also Mr. Barchi, an engineer from the Sassuolo ceramic tile cluster.

<sup>25</sup> It was the first company to introduce single-fired kilns in Castellon; the first to introduce the Rotocolor decorative technology (invented by *System* and tested in *Porcelanosa* for two years before being marketed); the first in the Castellon cluster to use white-body clay (red-body clay was and still is the dominant material used in Castellon); the first to open retail stores; and the first to create a professional Marketing department, together with many other organisational and technological innovations. Its catalogue of products has been called the *Bible* of the industry, and each year it has served as an *inspiration* to local companies designing their own products.



founders of Azu-Vi and Zirconio), the Colonques family (diversifiers from the orange industry), Mr. Aclud (an Italian engineer from SACMI, a leading firm in the manufacture of equipment for ceramic tiles in the Sassuolo cluster, Italy), and the firm Bonet (from the frits and glazing sub-sector of the ceramic tiles industry). This firm, Porcelanosa, with multiple parents (including Mr. Soriano from Azu-Vi and Zirconio, SACMI and Bonet) was created because Mr. Soriano wanted to implement a new business model (white body instead of red, and the creation of their own stores for distribution; Mr. Soriano continued as shareholder within Azu-Vi and Zirconio) as did Mr. Aclud, but it was a parent-company (incumbent-backed) venture from the Bonet point of view and a diversification for the Colonques family. This is one example of how new ventures can also be *hybrid* in nature, including many of the traditional forms, that is, a combination between a parent-backed and a *de novo* one.

CPJV, on the other hand, is the result of co-operation agreements between competitors (parent company joint ventures), usually from the same town, that try to adapt to new technology or to generate a collective initiative to assure the supply of some type of commodity for all of them. To adapt to a new technology, those agreements and the new ventures created were due to co-operation shown by a local (competitors) community of people, rather than between firms. This means that instead of controlling the new venture from the parent one (as a % of stake), it is the owner of the parent company who, individually, takes a % of stake in the new venture, avoiding the transfer of potential risks of failure to the parent company. All new founders kept working in their parent firms and all of them transferred knowledge to the new one. Thus, the flow of knowledge between the multiple parents and the progeny was pervasive even after the creation of the new venture, because both companies shared, at least in part, the same founders and even management<sup>26</sup>. Furthermore, we also reported cases (for the creation of atomizers, necessary in the transition to single-fired tech) where the firms themselves, and not the founders of them, took the % of stake in the new firms. In this case, these new firms were atomizers, providing to each member (shareholder) the atomized clay necessary for the single-fired production process. Again, social ties and belonging to the same town both influenced the creation of these CPJVs.

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<sup>26</sup> Most companies were and are SMEs, sharing ownership and management.

As regards these CPJVs, we described three examples but documented 15 in total. There may be more. After the Spanish Civil War, during the 40s, all industries were totally collapsed. In Onda and Alcora, the first two concentrations around Castellon, local businessmen with ceramic tile knowledge created the first two parent company joint ventures: *Tilesa* in Alcora and *Realonda*, in Onda. These firms were started by prominent business families who used to have factories before the war. All of them, previously competitors, joined to re-start businesses in the tile industry. Similarly, but due to technological disruptions, some new firms during the 60s and 70s, like *Tau* and *Inalco*, were established to leverage the benefits of the new technology. *Tau* and *Inalco* were started in the late 1960s and early 1970s, respectively. They were spawned *collectively* by a coalition of local incumbents, or should we say, by a coalition of local ceramic tile competitors, and for some years after being formed they kept co-operating with the founders' companies. The incumbent founders were all local competitors. *Inalco* and *Tau* only focused on the first step in the firing process, providing the "fired biscuits" (fired clay) to their founders; the founders' companies then applied the second step in the process (decoration) which served to differentiate their products. Thus, *Inalco* and *Tau* were parent-company (joint) ventures, controlled by local existing competitors who co-operated through the joint establishment of spin-offs for the purpose of keeping abreast of new technology<sup>27</sup>. As above mentioned, that co-operation occurred between local businessmen, who individually participated in the new firm while they kept working in their companies.

The significance of the co-operation was remarked upon by one of the founders. During the interviews, one of the founders of *Inalco* (who is now a manager of another local firm<sup>28</sup>) [Mr. Carlos Cabrera] said:

*"The founding of Inalco was important not only as a signal that the cluster was evolving technologically in the right way.....but it was the first time that we (families of the industry) evolved and shifted from being owners of our own factories to being partners and friends with local rival (families) competitors...something not previously usual in the process of founding new firms...a process mainly controlled by the families.....albeit we were all then cooperating indirectly in other matters such as exporting, lobbying, and so forth....."*

Not only was there co-operation between the founders, all of them competitors. There was also co-operation between the new spin-offs and the founders' own companies. In another interview, the ex-manager of *Tau* remarked on the importance of knowledge

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<sup>27</sup> Inalco was created by Hispanoazul, Iberoalcorense, Color y Ceramica, Cabrera, and Torrecid y Plaza. Tau was created by Diago, Gómez-Gómez and Tilesa, as principal partners.

<sup>28</sup> Mr. Cabrera, CERACASA firm.

transmission from the founders' own companies to the new spin-off [Mr. Carlos Camahort, ex-manager at Tau]:

*“During the setting up of the firm....I visited different factories with the founders, their own companies, learning, asking, questioning everything.....I had open doors to transfer knowledge to the new firm...Yes, I can assert that we inherited or learned from the best at that particular time and this was probably crucial for understanding our long term survival and innovation, outperforming our own founders when we detached from them....”*

*Inalco* and *Tau* were two examples of parent-company (joint) ventures. In fact, both spinoffs ended up in the late 1980s competing against their founders, when the technology used in ceramic tile firms was disrupted again by the introduction of the single-fired process<sup>29</sup>. Both spinoffs are now very innovative, active companies.

This, undoubtedly, contributed to the vertical disintegration of the MID, providing a more intense division of labour as in Helfat's (2015) way. Traditional *de novo* spinoff was continuously important but less relevant in periods of disruption. As observed, co-operation agreements (parent-backed or joint ventures) are pervasive. Family ties are also important. In table A-1, in the Appendix, we show some examples of parent-backed spinoffs, both parent-spinoffs and CPJV, among other *de novo* ventures.

### 5.3 Analysis of interviews

We also synthesized data from interviews in order to explicitly track learning mechanisms in each firm. Specifically we assess what was explicitly learnt and by whom, trying always to disentangle different sources such as ex-employers, social ties, parent's networks and so forth. We assessed explicit learning from informants' articulated statements in response to our above mentioned direct and indirect questions.

*“It is impossible to tell you that (the creation of) our firm was based on a disagreement with our parents. Our firm had many parents and reasons (for being established), not solely one, as you insist... We kept co-operating with our parents in some activities at the point of our firm's establishment, even though we wanted to create a new way of doing things, turning from red to white clay, opening stores... Our partners in that new venture were all local people from the industry with their own firms. We knew and trusted one another. It was just about co-operating and forming new firms in order to face new problems and opportunities in the industry.... Nothing in the process of firm creation in this cluster, to the best of my knowledge, is black or white, agreement or disagreement based; we had been co-operating in many other*

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<sup>29</sup> Both companies were acquired by some of their founders. This means that they did not fail, but continued with different shareholders. Had we simply measured survival rates, the two companies would have disappeared from the counts; but in fact they continued as competing companies. *Tau* transitioned to the single-fired process in 1984. At the present time (2014) they are both significant players in the industry, especially *Tau*. See more on the *Tau* history (retrieved in January, 2014: [http://tauceramica.com/610010\\_es/Tau-cer%20mica-protagonistas-de-la-evoluci%C3%B3n-innovadora-de-la-cer%20mica-mundial./](http://tauceramica.com/610010_es/Tau-cer%20mica-protagonistas-de-la-evoluci%C3%B3n-innovadora-de-la-cer%20mica-mundial/))

*previous ventures... and also with many others who voluntarily established their own way....This is the usual way of doing business here. It does not mean that co-operation is the only way, but it is very extensive here....”*

--Extract from an interview with a senior manager at Porcelanosa--

For the sake of brevity we provide a summary of our most significant results. A full genealogical map and detailed data is available upon request. In short, our case has followed a completely different pattern from those in the literature which show organisational reproduction as occurring through *de novo* spin-offs and which are accompanied by analyses of survival rates. Overall, during all the entrepreneurial waves in Castellon, it was found that ex-post co-operation between founders and new firms was persistent, and was reinforced by family and personal linkages and also through inter-firm sub-contracting agreements. Most of the company managers and founders originated from the same region, lived and socialized in the same neighbourhoods, were mainly trained in the same engineering school (Universitat Jaume I and ITC), and shared membership of the same trade associations (such as Ascer, ATC, and Anffecc) and social clubs. One key fact was that all new entrepreneurs were local. This induced strong personal ties which facilitated networking, trust and co-operation. This extensive and intense social structure cannot be captured simply by analysis of entry and exit rates. In table 4 we summarise our main findings, where *de novo* spinoffs and agglomeration forces are intertwined, forming rather *hybrid* new ventures. See table 4

**Insert table 4 here**

As shown in table 4, our results suggest a clear reconciliation between the two approaches. Although the relevance of the agglomeration perspective stands out, the inheritance approach's value is also clearly supported and it is pervasive. In fact, it can be said that the MID perspective complements, expands and enriches the inheritance approach. Put differently, the knowledge legacy from incumbent parents is always stressed, but it is in coalition with agglomeration and socially-based co-operation.

Below we highlight our main findings:

First, it is clear that having *local insider status* is directly relevant to the learning process in agglomerations. It means that new entrants from the local, focal industry, new entrants from other co-located industries (local diversifiers), and even local startups enjoy superior

*ex-ante* tacit knowledge due to privileged access to contacts, network ties and social capital, albeit to different degrees. As Sorenson and Audia (2000:426) show, without prior experience in the industry, a potential entrepreneur will find it difficult to benefit from the local social structure. Our evidence confirms similar findings in other works (Agarwal et al., 2004; Agrawal, Cockburn and McHale, 2006). As Agrawal et al, (2006) show, the social relationships that facilitate knowledge flows are very important, to the extent that co-location within an institutional context endures over time. The vast majority of the new firms in the Castellon cluster<sup>30</sup> were started by local entrepreneurs from the focal and other, even non-related, industries. Before the creation of their new firms, founders had abundant information about production issues and the local environment, mostly tacit in nature, and had important social ties, which minimized the prospects of failure. This fact confirms the salience of observations in the literature which states that entrepreneurs might be locally embedded (Figueiredo et al., 2002; Stuart and Sorenson, 2003; Agrawal et al., 2006; Dahl and Sorenson, 2009). Beyond formal inter-firm relationships with the parent's network, informal and personal-based ties also matter. Those personal-based ties not only derive from the parent's networks but also from the new entrepreneur's own social structure, which develops inside the networks of the parent. Conciliating both views, Buenstorf and Klepper (2009:714-715) point out that *entry was largely an indigenous phenomenon...potential entrants are assumed to have economic knowledge*, a fact also sustained by Figueiredo et al., (2002). Moreover, we do recognize the fact that familiarity with the home region may (partially) substitute for objective advantages of agglomeration (Figueiredo et al., 2002; Buenstorf and Klepper, 2010). Our study's results indicate, however, that the agglomeration effects were objective and existed, and these were probably exploited mainly by local insiders who had pre-entry information about them. According to the interviews, we can also state that all new entrants were local business people: home entry is more pronounced in agglomerated regions, perhaps due to the agglomeration effects which permit even stronger and better arrangements for organizing new ventures by connecting available local resources. We also think that local business people knew the existence of those agglomeration effects before entry, diminishing information asymmetries.

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<sup>30</sup> With the exception of some multinational companies which established a branch in Castellon: Ferro (USA), Johnson Matthey (UK), Colorobbia (Italia), Marazzi (Italia), mainly in the frits and glazing industry, albeit needing local partners to enter; e.g. Marazzi entered in partnership with Gaya and Peñarroya, both local producers.

Second, as shown in table 2a, the focal cluster does present objective advantages. Put differently: agglomeration effects attracted new ventures, as the vast majority of the new entrants during the 20<sup>th</sup> Century clustered around Castellon, being mostly or entirely local business people. This fact strengthens the agglomeration effects pointed out in the two literatures, although more strongly in the MID approach. It is important to stress that the first Artisan School of Ceramics in Spain was established in 1929 at Onda (Castellon) and the first Spanish Royal Factory for Ceramics (1727) was also established in Alcora (Castellon), along with the availability of the best red clay quarries for ceramics. Undoubtedly, these historical antecedents could have supported the confirmation of those externalities in the area.

Third, parent's networks, based on subcontracting, are learning mechanisms for new ventures, in addition to the internal conduits between spinoffs and parents. Results suggest a strong co-operation phenomenon, based on inter-firm subcontracting relationships. This network-based co-operation process permits new ventures to learn from their parents' networks, assuring their survival and development at the time of entry. Parents' networks are useful for guaranteeing that new ventures will get off the ground (Hellmann, 2002; Stuart and Sorenson, 2003).

Fourth, the above subcontracting co-operation process is reinforced by the identification of specific co-operation agreements in relation to the formation of new firms. We have identified firms which, on an agreement basis, spawned other firms (parent-backed spin-offs), followed by intensive cooperation between founding firms and their spin-offs. Results also suggest there were extensive co-operation processes among incumbent competitors who joined together to form new joint ventures (company parent joint ventures). Competitors co-operated in order to be more competitive by minimizing the risk of transiting to the use of radical technologies by sharing their costs and learning processes.

Fifth, we also identified old established local families who owned firms dating back to the late nineteenth century and early twentieth century who created new firms for family members. These "family" co-operations were reinforced by traditional (vertical and horizontal) inter-firm knowledge exchange. In some cases we could only track the

families, rather than the companies, due to the fact that in some cases different members of a family with the same name collectively controlled a complex group of firms<sup>31</sup> .

The above four points suggest that agglomerations constitute learning environments which foster entrepreneurship and new firm formation by offering new ventures at the time of entry access to superior knowledge. Moreover, the learning environment is also beneficial for parents: they combine external (externalities) and internal knowledge to create superior knowledge which may eventually be transmitted to their progenies, reinforcing the role played by internal conduits mentioned by inheritance approach.

Sixth, we also identified *de novo* entrepreneurial spinoffs, spinoffs which did not engage in co-operation after entry with their parents.

In figure 2 below we present graphical examples of the types of new firms in the cluster (2-A, the *Cotanda* and *Piñon* family group; 2-B, parent spin-off around *Porcelanosa*; 2-C, parent company ventures to initiate *Tau*; and 2-D, parent company ventures to initiate *Atomizadora*), complementing thus Table 2. More examples are available upon request.

**Insert figure 2 here**

As observed, both legacy and agglomerations co-existed in the formation of the Castellon cluster.

#### **5.4 Discussion of findings**

As regards CPJV, the collective action of facing new radical technology adoption by creating new ventures funded by existing competitors' co-operation agreements is a novel finding that shows how radical the technologies to force existing competitors to co-operate were, shedding light on how a socially-based entrepreneurial process plays a key role in the transition of the cluster to a new growth stage. This directly relates to and complements the cluster life cycle view. As suggested by Menzel and Fornahl (2010:219), the increase in heterogeneity permits a cluster to move back in the cycle, entering into a new growth stage, especially when the changes that increase heterogeneity are of a more radical nature, as in the case of the transition to the twice-fired and the

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<sup>31</sup> Such families included: Peris, Nomdedeu, Diago, Gomez, Gaya, and Sanchis, amongst others.

single-fired production systems in Castellon. Beyond traditional vertical subcontracting and horizontal informal exchange of know-how, confronting radical changes that threaten the existence and survival of the local firms, even competitors have collaborated to start new ventures in order to adapt to new radical technologies: to the very best of our knowledge, this is the first time this phenomenon is documented in the study of clusters/industrial districts.

As aforementioned, a firm's construction of capabilities goes beyond a firm's boundaries and competitive interactions generate relational capabilities (De Carolis et al., 1999) and returns (McEvily and Zaheer, 1999). In particular, social ties or informal relations amongst the local community of business people facilitated the necessary co-operation to cope with increasing heterogeneity, and the cluster itself entered again in a new growth period with superior productivity. Our case is connected to the Menzel and Fornahl (2010) framework as it provides real evidence about cluster rejuvenation and how socially-based ties play a crucial role in supporting and facilitating transition across stages.

Similarly, most of the parent-backed spinoffs occur from the social base that joins the different actors: most of them were and presently are socially tied (especially family-based ones). As many informants stated, backing and promoting new ventures, mainly for subcontracting processes or for the creation of new capabilities for new product lines (e.g. extending from red to white-body clay products), was also a way to create a decentralized network-based production system that enabled the circulation and generation of knowledge just *within the family*, thus minimizing knowledge spillovers outside the groups.

All in all, our study has gone one step further in the debate because we found that there was not one but three different types of spin-off contributing to the industry agglomeration process. Two of these spin-offs were different from those identified by Klepper, and have not previously been referred to in the cluster literature. They are, following the seminal Helfat and Lieberman (2002) study: (i) multi-parent company joint ventures, forged by a coalition of local rivals; and, (ii) incumbent-backed spinoffs (parent spinoffs) which also then co-operated with their parents. These new ventures did not fit in the traditional classification of "de novo", "diversifiers" and "startups", but nevertheless participated in cluster formation, and created and transmitted knowledge. They provided a clear demonstration of the role played by agglomeration, and by



extensive social capital in the Castellon ceramic tile MID. Moreover, the way these two types of spin-offs operated contradicted most of the taken for granted assumptions about spin-off processes in the inheritance approach. Klepper and colleagues focus mainly on de novo spinoffs without considering other alternative ones, such as the corporate-parent spinoff suggested by Helfat and Lieberman (2002). Obviously, the lack of relationship between parents and progenies emphasizes the potential influence of cooperation or the network effect, because that lack of relationship also excludes a new venture from being closely connected to the former parent's network and thus having access to those flows of external knowledge. As Buenstorf and Klepper (2009:731) remark, *a recurrent finding is that spinoffs had little ongoing relationship with their parent firms...nor transaction with their parents.....they were motivated by a disagreement with their parent firm*. While this is also true of clusters, it is not the only way spinoffs prevail in clusters.

In table 5 we summarise the mechanisms at work in the cluster formation and evolution process, with the purpose of providing a clear answer to our research question.

**Insert table 5 here**

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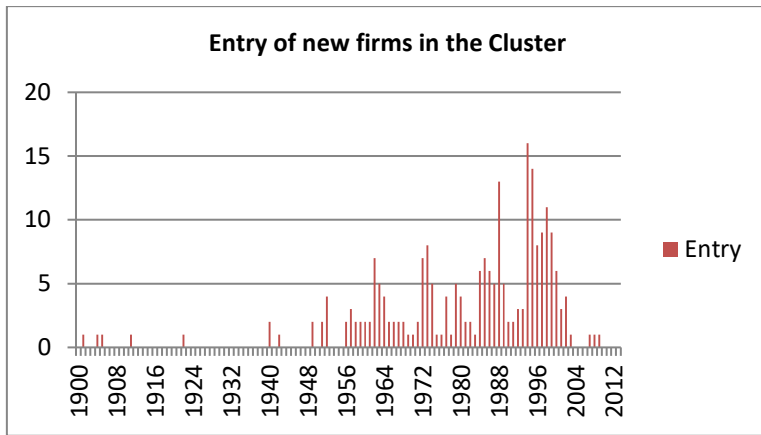
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## Figures and tables

Figure 1. New firm entries during 1900-2012.





Source: own based on Ascer data.

Figure 2 Types of new firms in the cluster: some examples

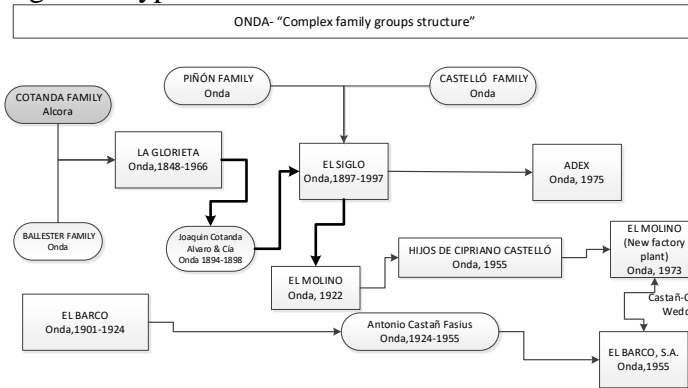


Figure 2-A

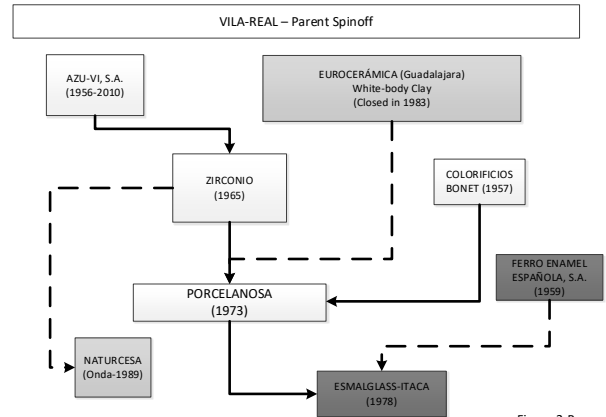


Figure 2-B

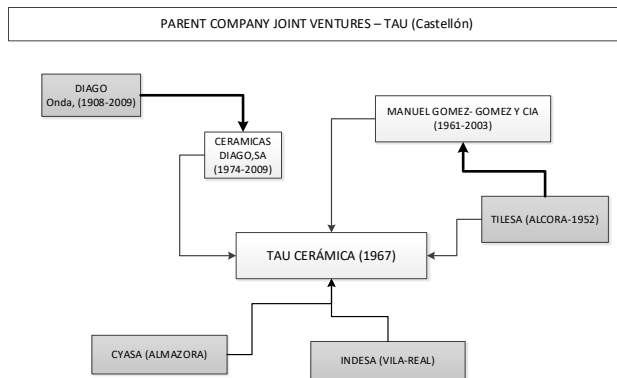


Figure 2-C

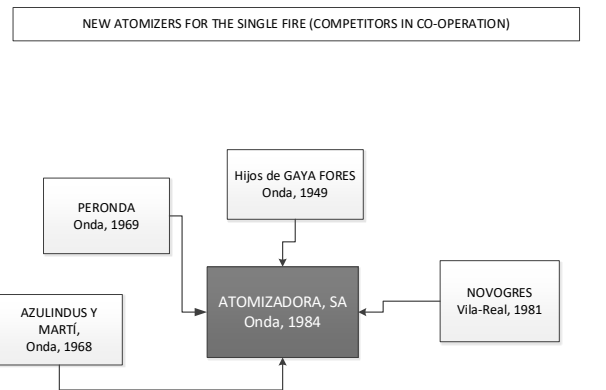


Figure 2-D

Source: own, dashed lines showing Klepper disagreements in 2-B

Table 1 Summary of results from the data analysis and interviews: a longitudinal analysis 1972:2010

Period	Characterised by
1727 to 1900	-Inception and fermentation. The first entry of a diversifier (Royal Ceramics Factory) (from the Army, which controlled most of the Royal Factories). Agglomerations formed based on extensive use in the area of the Arab kiln tradition. There were 22 Arab Kilns working at that time in ceramic table ware. Key was access to high quality red clay quarries. Local insider status was prominent in waves of spinoffs. Spinoffs occurred directly from the Royal Ceramics Factory (e.g. <i>Guinot, La Valenciana, La Campana, La Esperanza, and El Leon</i> . All of them were founded by Royal Ceramics Factory ex-employees). The influence of agglomerations was less important. The role of parent-progeny knowledge transfer was crucial.
1900 up to 1950	The spin-off process was important, and was mainly based on family ties. In 1946, 38 companies in the area accounted for 60% of Spanish production (Membrado, 2011). The <i>Ceramics School</i> was established in Onda (existing 1929-1936) as a training school for artisans, and was a source of new spinoffs –The influence of inter-firm ties was important, and complex family business groups were becoming prominent. The influence of local cluster insider status was strong, and the effect of agglomeration, with local institutions, was increasing in importance– The Civil War in 1936 stopped production up until the 1940s. Technology was very low with Arab kilns.
The 1950s	The entrance of local diversifiers was important, and resulted in the industrialising of an artisanal industry (especially in Villareal). The influence of local cluster insider status was strong. New firms co-existed with old family controlled manufacturers dating back to previous centuries (in Onda and Alcora). Inter-firm ties based on subcontracting developed. The effects of agglomeration were starting to be important.
1960s and 1970s	There was an entrance of local diversifiers and the occurrence of a very important spin-off process. Inter-firm ties grew in importance. The influence of local cluster insider status was prominent. There occurred the formation of new firms through rivals’ co-operation agreements in the face of the threat/opportunity of radical innovations (related to the new twice-fired process). Institutions in the area increased, and at the regional level new research institutions were set up, including the ceramic tile research laboratory in Valencia University, Valencia. Extensive co-operation based on subcontracting was evident, as long as the division of labor intensified. The cluster was achieving a critical mass and there is evidence of very strong agglomeration effects. Technology was disrupted by the twice-fired process.
1980s	No more diversifiers entered, but spin-offs played an important part. A skilled labour pool was consolidated, and there was high labour mobility. Very important institutions were created. Trade associations, a vocational training centre, and other institutions were developed, including the international trade fair (Cevisama). The ceramic tile research laboratory in Valencia was consolidated and transferred to Castellon as the ITC. The influence of local cluster insider status was prominent. New firms were founded through rivals’ co-operation agreements in the face of the threat/opportunity of a second radical innovation (single-fire). Extensive co-operation based on subcontracting occurred. Multinational companies from the Sassuolo cluster in Italy entered the cluster. There occurred very strong agglomeration effects. Second important tech disruption (single-fire).
1990s	The spin-off process decreased in importance. There were no more entrances of local diversifiers. A skilled labour pool had been consolidated and there was high labour mobility. The influence of local cluster insider status was prominent. The local University Jaume I, along with the ITC, offered ceramics industrial engineering courses. Strong co-operation networks were pervasive. The cluster had become a meta-cluster and included all the necessary value chain activities. An “innovation system” was fully operational with extensive co-operation networks and institutional support. There was an increase of multinational companies. Agglomeration effects were very strong.
2000s	The spin-off process was overall important with some significant ones (e.g. Kerajet, a new spinoff, instigated a new technological disruption through the invention of new digital ceramic decoration methods). There occurred a high number of entrants into the cluster of diversifiers from the inkjet industry (participating in the technological breakthrough based on the new process of digital decoration). New entrants from outside allied with local firms (testifying to the importance of cluster insider status). The skilled labour pool was consolidated and there was high labour mobility. Existing

	institutions were consolidated and developed a powerful lobby capacity towards regional and central government. A world-class ceramic tile cluster had been established. There were very strong agglomeration effects. After 2005 the cluster leapfrogged its rival in Sassuolo, Italy, by developing the new ceramic digital decoration technology. In 2006 production peaked at 600 million square metres, and employees numbered 25,000, surpassing Sassuolo on all levels (see more in Hervas-Oliver and Albors-Garrigos, 2014).
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Source: own

Table 2a. Percentages of new ventures originated inside and outside the Cluster in Spain during the 20<sup>th</sup> Century (only ceramic tiles)

	1900-1910		1910-1920		1920-1930		1930-1940		1940-1950		1950-1960		1960-1970		1970-1980		1980-1990		1990-2000		2000-2010		TOTAL	
CASTELLÓN * 49 firms in 1929	2	66.6%	1	33.3%	2	66.6%	2	40%	1	20%	17	89.47%	28	71.79%	39	76.47%	56	81.16%	87	82.86%	14	77.78%	249	77.81%
OUTSIDE CASTELLÓN	1	33.3%	2	66.6%	1	33.3%	3	60%	4	80%	2	10.53%	11	28.21%	12	23.53%	13	18.84%	18	17.14%	4	22.22%	71	22.19%
TOTAL	3	100%	3	100%	3	100%	5	100%	5	100%	19	100%	39	100%	51	100.00%	69	100.00%	105	100.00%	18	100.00%	320	100.00%

\*percentage calculated for the whole period 1900-2010 (total number of companies: 320); Source: own elaboration from ASCER data. Nevertheless, in 1929 a total of 49 firms existed in Onda and Alcora, entering during the 19<sup>th</sup> Century

Table 2b Percentages of net (entries-exits) ventures entering inside and outside the Cluster during 20<sup>th</sup> Century

	1900-1910		1910-1920		1920-1930		1930-1940		1940-1950		1950-1960		1960-1970		1970-1980		1980-1990		1990-2000		2000-2010		TOTAL	
CASTELLÓN * 49 firms in 1929	2	66.67%	1	33.33%	2	66.67%	2	40.00%	1	20.00%	17	89.47%	28	71.79%	39	76.47%	56	81.16%	69	83.13%	-77	85.56%	140	73.68%
OUTSIDE CASTELLÓN	1	33.33%	2	66.67%	1	33.33%	3	60.00%	4	80.00%	2	10.53%	11	28.21%	12	23.53%	13	18.84%	14	16.87%	-13	14.44%	50	26.32%
TOTAL	3	100%	3	100%	3	100%	5	100%	5	100%	19	100%	39	100%	51	100%	69	100%	83	100%	-90	100%	190	100%

\*percentage calculated for the whole period 1900-2010 (total number of companies: 320); Source: own elaboration from ASCER data. Nevertheless, in 1929 49 firms existed in Onda and Alcora, entering during the 19<sup>th</sup> Century

Table 3 Type of new entrants in our sample during the 20<sup>th</sup> Century

Type of new ventures	CPJV			Parent Spinoff			Other (de novo, diversifiers...)			Total by period	
Years	Absolute	% per period	% per type	Absolute	% per period	% per type	Absolute	% per period	% per type	Absolute	% per period
1900-1950	0	0.0%	0.0%	5	71.4%	5.7%	2	28.6%	3.1%	7	100.0%
1950-1960	2	14.3%	13.3%	5	35.7%	5.7%	7	50.0%	10.9%	14	100.0%
1960-1970	3	11.5%	20.0%	10	38.5%	11.4%	13	50.0%	20.3%	26	100.0%
1970-1980	6	15.8%	40.0%	23	60.5%	26.1%	9	23.7%	14.1%	38	100.0%
1980-1990	4	8.5%	26.7%	28	59.6%	31.8%	15	31.9%	23.4%	47	100.0%
1990-2000	0	0.0%	0.0%	15	48.4%	17.0%	16	51.6%	25.0%	31	100.0%
2000-2010	0	0.0%	0.0%	2	50.0%	2.3%	2	50.0%	3.1%	4	100.0%
<b>Total (1900-2010)</b>	<b>15</b>	<b>9.0%</b>	<b>100.0%</b>	<b>88</b>	<b>52.7%</b>	<b>100.0%</b>	<b>64</b>	<b>38.3%</b>	<b>100%</b>	<b>167</b>	<b>100.0%</b>

Source: own elaboration, based on ASCER data.

Table 4 Mechanisms at work during the process of formation and evolution of the Castellon MID cluster

Mechanisms: building theory	Some representative quotes:
<p><b>Local cluster insider status.</b> This provides access to local inter-firm networks and informal personal ties within and beyond those of the parent. Consequently, agglomerations in MIDs are more easily accessed by <i>local entrepreneurs</i> than by new entrants from other regions.</p> <p>Intensive social capital or social structure favours “local entrepreneurs”, entrepreneurship, the development of knowledge asymmetries, and the creation of barriers to entry for outsiders. Outsiders cannot access channels and networks under the same conditions.</p>	<p><i>“Most entrants were and are local entrepreneurs from local business families...they had all the resources, beyond the financial ones to startup and succeed in the industry..... connections. partnerships. reputation to hire....”</i></p> <p><i>“Yes, we knew outsiders....they brought money...but they all needed a local businessman to access the cluster.....”</i></p> <p><i>“Businessmen from other regions also invested....especially in the 60’s. but always backed by local businessmen who advised and shared partnerships.....”</i></p>
<p><b>Parent’s subcontracting-based networks as learning mechanisms.</b> Agglomeration matters. Fostering entrepreneurship by providing insiders with access to extra-resources (including networks, intermediate inputs, and knowledge). Agglomeration complements the spinoff knowledge transmission mechanism.</p> <p>New entrepreneurs in MIDs learn from the existing parents’ networks. New ventures tend to co-locate with the networks of parents because accessing those localized resources helps to assure survival and development. Agglomeration (composed of inter-firm and personal networks) matters before and after entry. It provides an additional asset, the value of which is reinforced by local insider status and pre-entry industry experience.</p>	<p><i>“Outsiders. especially those from the Italian cluster. are not our people but help to do things differently....I do not think they access the same information and know-how we all do..., we all know each other who can be or can not be trusted....”</i></p> <p><i>“Personal ties are more important than formal inter-firm agreements....my friends mostly work for the industry and we regularly meet for a meal...of course we share issues...you have to live and socialise here to keep learning.....”</i></p> <p><i>“Some of my rivals’ managers are also my friends and we were all trained in the same school...It does not mean we share everything....but we respect each other’s view and opinions about current affairs....”</i></p> <p><i>“How do we learn? From the loads of people you know here in the local industry....and of course your industry experience matters ...it is not only about industry experience but whom you worked for before...”</i> <i>Working and socialising in the cluster gives you knowledge about most of the key issues...”</i></p> <p><i>“...learning from suppliers. customers. your work mates....and your personal ties: ...when we started up we kept working with the same ex-employer’s suppliers, it was easy and the only way to get on because we trusted them....”</i></p> <p><i>“... my friends also work in the industry and when we meet we just talk about ceramics and making money.... my dad was here for 30 years...he knows who to ask and meet when necessary...all this knowledge and connections go with you wherever you work in this industry....”</i></p> <p><i>“What knowledge from networks do you mean? Of course you learn from your ex-employer’s suppliers and customers...but most of the useful knowledge is not officially from the inter-firm relationships but from the personal ties you cultivate with those suppliers’ workers....you’ve got them no matter where you move to....”</i></p>
<p><b>Parent-backed spinoffs mainly from family groups.</b> New ventures include parent-backed spinoffs, including many belonging to family groups.</p> <p>The existence of continuous co-operation with the parent-company means that new ventures keep learning from the parent’s networks and also from the parent’s internal conduits at the time of entry and post-entry.</p>	<p><i>“You see firm A. B. C and D. they are all family....different brands but we all know they do not compete.....no. they do not need cross-sharing....the family itself owns all the four firms<sup>32</sup>....”</i></p> <p><i>“Sometimes companies supported new spinoffs for members of the family who decided to become entrepreneurs....creating new firms for complementing or expanding the current products...the support persisted with or without explicit and formal ties....”</i></p> <p><i>Do you know Kerajet, the digital decoration disrupter? It was a high-risk project that Ferro did not want to have inside. No one wanted that</i></p>

<sup>32</sup> Firms A = Aparici, B= Apavisa, C=Superceramica, D= Undefasa, all from the Aparici family.

	<p>responsibility....they decided to spin it off and gave support with 25% share and access to the R&amp;D labs....thanks to that decision Castellon leapfrogged to digital printing for ceramic decoration.... They (Ferro) regret not holding on to the new firm..... although they keep working together.” Ferro did their best to provide the new inks for the new technology<sup>33</sup>....”</p>
<p><b>Company parent joint ventures.</b> These are enterprises founded by companies who co-operate specifically to create spinoffs. In some cases the co-operators are also incumbent competitors.</p> <p>Through continuous co-operation the new joint ventures learn from the parents’ networks and also from the parents’ internal conduits at the time of entry and post-entry.</p> <p>Agglomeration is crucial for favouring local joint ventures, including among local competitors.</p>	<p>“It was a way to pass from being an owner to being a partner with my competitor! We could not access the new technology individually....forming those partnerships allowed us to be at the forefront of the new technology. All the partners brought their best technicians to be sure the new firm worked...so I suppose we all taught the new workers how to do things....(referring to the creation of INALCO<sup>34</sup>).”</p> <p>“Our parents gave us all the necessary knowledge and training during the first decade ...Then, a second (technological) disruption came (i.e. the single-fired method), also changing ownership... We ended up competing against our parents in the advent of the second disruption....we learnt from all of them...”</p>
<p><b>Learning mechanisms through the parent’s internal conduits.</b> <i>De novo</i> entrepreneurial and disagreement-based spinoffs occur in MIDs and contribute to spatial industry clustering in the manner described by Klepper.</p> <p>Learning is transmitted through conduits linking the new firms to their parents. At the same time, learning at the time of entry also occurs through the parents’ networks and through local personal ties.</p>	<p>“Yes, some new firms arose from conflicts and different points of view...yes, disagreements are also motives for new ventures and they do not usually keep working together...except when they are family...this is different. It all depends on who they are.....”</p> <p>“People start up because they think they can do it better...once they learn know-how. knowing-who...the environment helps to start up, also the personal connections and ties...it is impossible to start from scratch: if you start up in this industry you need the environment to survive...”</p> <p>“...yes, they had a disagreement with their ex-employers because of the too-late adoption of the digital technology....and they started by developing new software for improving colour composition with that technology: they developed it with the same supplier they used to work with at their ex-employer’s...yes, the new firm used the same network...”</p>

Source: own. from the interviews

Table 5 Summary of the mechanisms at work in the cluster formation and evolution process in the Castellon MID: inheritance and agglomeration forces at play.

New ventures in the cluster	Who entrepreneurs were?	Learning mechanisms	Mechanisms and implications for MIDs
De novo entrepreneurial spinoff	<p>Local entrepreneurs from the focal industry.</p> <p>Also, local entrepreneurs from local diversifying industries.</p> <p>Local insider status pervasive and persistent.</p>	<p>-Parent’s internal conduits</p> <p>-Parent’s networks</p> <p>-Personal ties with local co-workers</p>	<p>Inheritance and agglomeration mechanisms important.</p> <p>Parent’s internal conduits are key. In addition, local insider status pervasive and persistent.</p> <p>Agglomerations complement the inheritance process for firm creation.</p>

<sup>33</sup> Also in Hervas-Oliver and Albers-Garrigos (2014).

<sup>34</sup> Carlos Cabrera, manager at Ceracasa (Ceracasa founder’s son). The firm Ceracasa was one of the INALCO founders (along with Hispanoazul, Mallol, Gayet Fores and other firms in the early 60s).

Parent-backed spinoffs	Local entrepreneurs from the local and focal industry, mainly from within family groups.  Agreement and co-operation based spinoffs.	-Parent's internal conduits: pre- and post-entry  -Parent's networks: pre- and post-entry  -Personal ties with local co-workers	Inheritance, agglomeration and socially-based MID mechanisms important.  Spinoffs based on extensive co-operation.  Agglomeration and socially-based co-operation both complement the inheritance process for firm creation.
Corporate parent joint venture (CPJV)	Local firms from the focal industry.  Agreement and co-operation based spinoffs.	-Parent's internal conduits: pre- and post-entry  -Parent's networks: pre- and post-entry	Inheritance, agglomeration and socially-based MID mechanisms important.  Spinoffs based on extensive co-operation amongst incumbent competitors.  Agglomeration and socially-based co-operation, both complement the inheritance process for firm creation

Source: own

## APPENDIX

Table A-1 Some examples of the organisational reproduction in Castellon MID and main mechanisms prevailing

Firm	Local insider status*	Parent-backed	Company-parent joint venture	Family co-operation/de novo spinoff	Vertical disintegration (division of labour)
El Molino (1922)	Yes. 100%	-	-	El Siglo (1897-1997), de novo spinoff by disagreement	No info
Zirconio (1965-2010**) leading gatekeeper up to 2000s	Yes. 100%	Azuvi (1965-2010)	-	Family ties extensive; basically the same shareholders from Azuvi (Azuvi did not own Zirconio but Azuvi's shareholders individually did)	Changing from traditional to tunnel kiln technologies in the 60's
TAU (1967)	Yes 100%	-	Yes (Diago. Gomez y Cia, Tilesa. Indesa, Cyasa, among other partners)	Family ties not relevant	Twice-fired
Undefasa (1967)	Yes 100%	Ceramicas Aparici	-	Family ties relevant (parent owner and the partial owner and CEO of new firm were brothers)	Twice-fired
Peronda (1969)	Yes. 100%	Peris y Cia (1951-1969)	-	Family ties very intense; family split company in new ones, one for each member of the family	Twice-fired technology
Planomyr (1972)	Yes 100%	-	Yes (Nomdedeu, La Platera and MYR)	Family ties important	Twice-fired
Inalco (1972)	Yes 100%	-	Yes (Colorceramica, Hispano Azul. Cabrera. BIC, Plaza, Co-Pla, Torrecid)	No family ties but all new shareholders from the same hometown, very socially connected	Twice-fired
Porcelanosa (1973)— absolute world leader in tiles	Yes. 100% ***	C. Bonet (1957) invest to secure new materials (parent-backed) And Soriano Family (leaving Zirconio). among others	-	Soriano Family leaves Zirconio (de novo spinoff)	New white body ceramic tile and pioneering single-fired process and innovation in downstream activities (opening stores and so forth)
Esmalglass (1978)	Yes. 100%	Porcelanosa. (1973). securing frits and glazes (parent-backed)	-	Ferro (1959): engineers from Ferro (Baigorri brothers, now Presidents of ANFFECC, frits trading association) leave and join	Frits and glazing for single-fire



				Porcelanosa to create Esmalglass (de novo, disagreement)	
Atomcer (1979)	Yes 100%	-	Yes (Ceramicas Aparici, Gaya, Tau)	No family ties	Single-fired (clay grounding)
Atomix (1980)	Yes 100%	-	Yes (Ceramicas Aparici, Gaya, Tau)	No family ties	Single-fired (clay grounding)
Atomizadora SA (1984)	Yes 100%	-	Yes (Peronda. Azulindus, Gaya Fores, Novogres, among others)	No family ties	Single-fired (clay grounding)
Tecnigres (1987)	Yes 100%	Ceramicas Aparici (parent-backed)		Family ties very intense	Single-fired technology
Naturcesa (1989)	Yes. 100%	-	-	De novo spinoff. Javier Rupert's disagreement with Zirconio (1965)	This firm was the first diffusing porous single-fire for wall ties in Brazil, as its founder invented it while at Zirconio, Boix and Rupert families on the Board of Directors  Division of labour: Special tiles by extrusion technologies with porous single-fire
Azulejos Malloi (1998)	Yes 100%	La Platera	-	Family ties very intensive	-

Source: own. Based on our research. For the sake of brevity, full genealogy map available upon request. \* The origin of the new firm's entrepreneurs is local, from the same or different industry; \*\* Bought in 2011 by a Chinese entrepreneur from Foshan cluster (China); \*\*\* Mr. Aclud was an Italian engineer from Sassuolo living in Castellon.