Abstract
This paper examines the emergence process of the molds cluster in Portugal using an historical research approach. Applying a multilevel and contextualized point of view, the paper takes into account the antecedents and the complexity of the interrelations that lead to the creation of the cluster. The study highlights the role played by institutions in fostering the entrepreneurial spur that gave rise to the cluster’s emergence and later to its international success.
ABSTRACT

This paper examines the emergence process of the molds cluster in Portugal using an historical research approach. Applying a multilevel and contextualized point of view, the paper takes into account the antecedents and the complexity of the interrelations that lead to the creation of the cluster. The study highlights the role played by institutions in fostering the entrepreneurial spur that gave rise to the cluster’s emergence and later to its international success.
“The Emergence of a Cluster”

1. INTRODUCTION
The formation of industrial clusters is a phenomenon that long ago captured the interest of scholars. As much as the drivers of clustering have been dissected in theories focusing on agglomeration economies, heritage through spinoffs, or other theories, there is still not a broad understanding of the factors triggering the location choice of the very early entrants, which then lead to the build-up of an industrial cluster. Outside the predictable cases associated with the presence of natural resources, most theories don’t venture beyond the assumption of a certain degree of randomness in the initial location decisions that start the clustering process.

This paper aims to apply a historical perspective to deepen our understanding of the emergence process of an industrial cluster. Such an historical approach has several advantages to address these questions. First, it allows tackling the complexity of the phenomena by embracing the many relevant aspects involved. Second, it incorporates multiple levels of analysis, therefore comprising the links between individual action, firm behavior, and structural changes at the level of the region, industry, and economy. Third, it overcomes the inherent quantitative data scarcity at a stage when still a very small number of companies venture into a new industry, while still allowing for interpretation. Forth, it allows an understanding of individual and collective action by providing the contextualized worldviews of the relevant actors.

By considering antecedents and the context, and looking at events and actors, we can begin to understand how a cluster emerged and which factors were dominant in triggering the process. The in-depth understanding of the emergence period can shed light on the developments in subsequent stages of a cluster’s history. In addition, the detailed analysis of the emergence of one cluster helps us understand similar processes in other clusters and contribute to identify the
similarities and communalities among different types of emergence processes. Under an historical research perspective we can apply logic to infer the process that could have taken place in order to generate as an outcome the structures (cluster) we can now observe (Ingram et al. 2012).

The case of the plastic injection molds cluster in Portugal, located in Marinha Grande (hereafter named Marinha), is an interesting example of a successful cluster with about 70 years of a very rich history, and with links to the glass industry, which has roots going back to the 18th century. By taking a comprehensive look at the context that ultimately lead to the emergence of this cluster we can gain an understanding of the factors that contributed to the phenomena. This is indeed a rich case (with a multitude of accessible primary and secondary data sources) from a so far understudied context: the Portuguese companies.

The analysis begins by considering the antecedents of the cluster creation. Then there is a narrative about the roles played by some of the main actors involved in the cluster’s inception. Finally, the paper attempts to focus on the main mechanisms identified in the analysis and discusses these findings.

2. LITERATURE REVIEW

Industrial clusters are often composed of disproportionate numbers of successful high-performing companies. This section briefly discusses two theories that propose different mechanisms leading to cluster emergence – agglomeration economies and heritage theory – and finally adds the perspective of institutional theory, which has been less prevalent in this discussion.
2.1 Agglomeration economies theory

Industrial clusters have been explained in mainstream economics as driven by the positive externalities derived from industry agglomeration, or agglomeration economies. Regional and urban economists model those as Marshallian externalities (Krugman 1991). In such models, the externalities resulting from increasing returns at firm level, combined with market size effects, lead to geographical concentration of producers, specialized suppliers, and also related industries. Becattini (1990) observed the clustering phenomena in Italian regions, and identified the so-called MID – Marshallian Industrial Districts, composed of large concentrations of small firms involved in the production of one homogeneous product.

In later years there has been an increasing focus on the role played by entrepreneurship in the industrial agglomeration process. This is based on the observation that the growth of regional economic employment, with all the associated positive implications for local development, has been strongly correlated with the presence of small firms, and hence with entrepreneurship (see for example Acs and Armington 2006; Feldman et al. 2005; Glaeser 2007; Glaeser et al. 2012; Glaeser et al. 2010a; Rosenthal and Strange 2010). Sorenson and Audia (2000) and Glaeser et al. (2010a) tested possible origins for this consistent observation and found empirical support to the differences in the regional endowment of entrepreneurs, as initially proposed by Chinitz (1961).

Glaeser et al. (2010b) imply that agglomeration economies are driving the entrepreneurship that builds up the clustering. In regions with a higher supply of entrepreneurs due to the prevalence of more small firms (Glaeser et al. 2010a), those entrepreneurs tend to locate their firms in the region due to, among other reasons, the attractiveness of the agglomeration spillovers (input sharing, labor pooling, and the opportunity to learn from their neighbors).
2.2 Heritage theory

An alternative view is that the clustering of entry is caused by an uneven regional distribution of potential entrants, who tend to remain located close to their geographic roots (Buenstorf and Klepper 2009; 2010). Klepper (2001; 2002) found that the blueprints of a parent firm are passed on to new firms through their founders, in the context of spinoffs. Agarwal et al. (2004) and Klepper (2008) argue that the knowledge inherited by founders was accumulated throughout their employee’s careers in industry incumbents, and this will determine the success of their ventures. Such knowledge is embodied in those founders, and complemented with the additional experience of the founding team (Andersson and Klepper 2013).

Entrants to new industries frequently locate in regions where precursor industries were already present (Buenstorf and Klepper 2009; 2010; Klepper 2001). Furthermore, numerous studies have shown that entrants tend locate in the region where their founders previously worked or were born (Dahl and Sorenson 2009; Dahl and Sorenson 2012; Figueiredo et al. 2002; Michelacci and Silva 2007). These studies propose explanations related to better access to different types of capital: social (local network ties), human (skilled and educated workers), and physical (sources of financing). Regionally bounded knowledge contributes to recruiting workers and assembling assets that entrepreneurs need to be successful (Delgado et al. 2010).

Buenstorf and Klepper (2009) propose that the build-up of a cluster is due to an endogenous process fueled by incumbent firms involuntarily spawning independent spinoffs. In the process of enhancing their performance through technological innovation and improved organizational processes, successful incumbents inadvertently function as training grounds for their employees, who thus develop the skills needed to start their spinoffs. This process increases the performance
of the resulting spinoff entrants (Boschma and Wenting 2007; Buenstorff and Klepper 2009; 2010; Cheyre et al. 2015; Heebels and Boschma 2011; Klepper 2007; 2010).

Golman and Klepper (2016) explain the role of entrepreneurship in cluster formation, by associating it with the market opportunities generated by incumbent led innovation. Their model shows that clustering may result exclusively from the self-reinforcing dynamic generated by innovation leading to spinoffs, possibly complemented by non-Marshallian positive externalities associated with entrepreneurship (like the demonstration effect and the availability of venture capital). Tacit knowledge would be transferred from the parent firm to the spinoff through the founders and the employees hired by the spinoff, and would not be readily available for other types of entrants.

2.3 Institutional theory

Institutional theory offers a different perspective to explain human and firm behavior, which goes beyond the pure rational choices prevalent in economic theory. The seminal work of Meyer and Rowan (1977), and later of Powell and DiMaggio (2012), highlighted the importance of looking at institutional rules and the way the environmental rules influence the structure of the organizations. This logic implies that, in order to understand a phenomenon such as industrial clusters, one must also consider the influence of the region’s institutional rules on the actions of the individuals and firms. Such view would include the rules, norms, customs, traditions, assumptions guiding behavior and cognition in the cluster setting (Hodgson 2005; North 1990).

Taking also an historical institutionalism point of view, it becomes clear that one must not only understand the impact of the institutional environment where the cluster developed, but also consider the history that preceded the emergence of the cluster. Path-dependence is arguably at
the core of the cluster formation process also through the inherent institutionalization process (if one regards the cluster as an institution in itself). It is important to also consider the impact of the behavior of the entrepreneurs themselves in the evolution of the structure of the cluster, the industry, and the region. This would imply considering some individual key decisions by entrepreneurs, collective action, the effect of role models, etc.

Although it seems intuitive that institutions play an important role in the emergence of an industrial cluster, this perspective remains understudied and both above discussed theories do not formally take into account their impact. However, this seems to derive more from the methodological challenges of embracing the role of institutions into the analysis than from the dismissal of their importance. In fact, the complexity of the relationships in the institutional setting and the temporal framing make it difficult to gain a deep understanding of their effects by using quantitative research methods.

3. ANTECEDENTS OF CLUSTER FORMATION

In order to better understand the emergence of the molds cluster in Portugal, one should carefully consider the antecedents that lead to that outcome, as endorsed by Forbes and Kirsch (2011) who made a plea for more studies of emerging industries. In the case of the Portuguese molds industry, it is necessary to analyze a predecessor industry, which rose in the same region, and whose history is interrelated: the glass industry. In addition, it is useful to investigate the national and international context at the time of the cluster’s emergence by considering the economic situation and the development of the plastics and molds industries internationally.
3.1 Advent of plastics

Natural materials with a ‘plastic’ nature were already used for long before the first semi-synthetic plastic, a nitrocellulose, was developed and patented in 1856 by Alexander Parkes (Aftalion 2001). In 1862, Parkes and a partner presented products made with this new material in London’s International Exhibition. In the US, the inventor John Wesley Hyatt heard about such developments, and built on this knowledge to create another new semi-synthetic plastic his brother then named ‘Celluloid’ (Aftalion 2001; Meikle 1995).

In 1907, Leo H. Backeland introduced in the US the first fully synthetic plastic, which he named Bakelite (Meikle 1995). In the following decades Bakelite was also produced in factories located in Europe (England, Germany, France). Bakelite belonged to a new class of polymer resins – thermoplastics – that turn liquid when heated and solidify to a glassy state when cooled.

The production of plastic materials boomed during WWII, but was mostly redirected to war-related applications, and only flourished openly in the post-war period. This product could be manufactured using plastic injection techniques (Gomes 1998), and therefore it brought a fundamental shift in the ‘way new materials came to existence’ by introducing considerable savings by eliminating the cost of separate fabricating, finishing, and assembling operations (Meikle 1995). Hence, after the war, companies like DuPont, Bayer, General Electric, Monsanto, Dow, engaged in a race for the development and commercialization of such new materials.

The initial motivation for the development of new plastic materials was the sheer substitution of natural supplies of horn, tortoiseshell, or ivory. However, soon plastic materials acquired an image of innovation that promised a new utopic world of possibilities. This fundamental image shift originated in the US. From a reputation of a low quality and low price substitute material, plastics evolved in the 1980s to be considered a symbol of the new technologies, consistent with
the cultural evolution in the modern American society later to be dubbed the ‘plastic age’ (Meikle 1995). Also Europe was influenced by this cultural focus on technology and new opportunities, of which plastic was a symbol.

3.2 Precursor industries

Long before the plastics and molds industries came to Portugal, important precursor industries arose in the same region: the glass industry, and later the glass molds industry. Because the presence of these industries cannot be dissociated from the emergence of the cluster, it is important to understand their common history. The mentioned precursor industries also had their origins in Marinha region (see Figure 1), and Oliveira de Azeméis region (located 130km further north and hereafter named Oliveira).

FIGURE 1 HERE

The first record of a glass factory in Marinha date from 1747 when the Irishman John Beare re-located the glass factory he owned in Coina (close to Lisbon) to Marinha (Gomes 1998; Gomes 1990). He aimed to locate closer to an abundant supply of the main raw materials for glass production: sand and firewood (fuel for the furnace). Marinha was indeed not far from the sea, and it was located in the center of Leiria’s pine forest, a dense forest several hundreds of years old, which belonged to the Portuguese crown. In addition, the region had good access to transportation by boat and by land for shipping final products and raw materials (Gomes 1990). However, the glass company faced considerable opposition and was eventually closed down by the administration of the forest, which was displeased with the large and careless wood consumption.
In 1769, the Portuguese King José I, and prime minister Marquis of Pombal, commissioned an English industrialist, William (Guilherme) Stephens, to restart the glass factory, then named ‘Real Fábrica de Vidros’ (Royal Glass Factory), in Marinha (Barosa 1993). Stephens accepted the king’s generous conditions and turned the plant into a successful glass factory that had a very strong impact in the region and soon became the largest manufacturing unit in the kingdom.

The factory required specialized workers, knowledgeable about glassworks. Such skillset was not abundant in a country with a very limited industrial tradition, so a few artisans were recruited from Italy, England, Ireland, and Belgium (Mendes 1980). These craftsmen would then teach the Portuguese apprentices their art, and this process eventually led to the creation of a large specialized workforce in the region.

William, and later his brother John James (João Diogo), managed the factory until 1826, when John died without descendants and donated the company to the Portuguese crown. In 1954 the company was named ‘Fábrica Escola dos Irmãos Stephens’ (Stephens Brothers’ School Factory) to honor the benefactors and acknowledge the role played by the factory as a school of the ‘glass art’ but also of the ‘entrepreneurial art’ (Gonçalves and Gomes 2004). By then the presence of this factory had induced the creation of many other small glass and crystal companies in the region and the buildup of a mass of specialized glassworkers.

Stephens forbade the sale of alcoholic drinks in the region and took care of the workers’ education by providing teachers for reading and writing, drawing, and music, and by organizing entertainment aiming to improve their cultural level (Barosa 1993; Neto 2014). These workers became symbols of the proletariat, and unions thrived in the region like nowhere else in the country. It was said that Marinha was the home of the ‘aristocratic proletariat’, and there are reports of a longstanding tradition of solidarity and complicity among neighbors that was very
unusual elsewhere (Henriques et al. 1991). This local proletariat culture thrived and persisted in
the region likewise during the emergence of the molds industry, playing an important role in the
process. Neto (2014, pp. 26) recounts his childhood in the region and how shocked he was when
he moved to Lisbon and met the local metalworkers who, contrary to what he saw in Marinha,
would not change their dirty clothes after work and would even spend their free time hanging
around the local grocery stores and taverns. He highlights the stark contrast with Marinha’s
generalized proletarian and political awareness, the dynamics of the union, and the frequent
conferences and theater shows, as well as the existence of a high quality industrial school.

By 1920 there was only one small glass molds producer in Marinha and another nearby in
Leiria. In fact “Real Fábrica” ordered glass molds from Lisbon, Figueira da Foz, and abroad –
Germany and Austria (Gomes 1998; Rodrigues 2002). This dependence from outside implied
long delivery times and high prices. Therefore, by the mid-1920s, one young toolmaker, working
at “Real Fábrica” since 1923, Aires Roque, asked the manager’s (Calazans Duarte) permission to
create a molds workshop, and, together with a skilled lathe operator, António Santos, he
produced the firstdie-cast mold for glass in Marinha using chromium steel (Henriques et al.

In 1926 Roque acquired in Lisbon a press-molding workshop (Gomes 1998) but later returned,
and then moved to Oliveira for nine months in 1927 (which had become another important glass
production region further north), in order to work in glass molds.

Calazans Duarte, who was the one to accept Roque’s plea to start producing glass molds,
described him as a bright and ingenious man with the ambition to improve his economic
condition and to rise in the social scale. However, he also refers that this legitimate ambition was widespread among the workers in Marinha, and therefore part of the local culture\(^1\).

### 3.3 Portuguese economy before WWII

Suffering the negative impact of the world economic crises that emerged after WWI and again after 1929, the country’s development in between the Wars was moderate but higher than the European average – 2.2% GDP growth rate between 1919 and 1939, while for the majority of European countries was 1.8% (Lopes 2001). There were improvements in agriculture and manufacturing, but the country faced high inflation levels up to 1924.

The military coup of 1926 established a dictatorship led by Salazar which prevailed until 1974. Salazar introduced financial reform policies as well as a state corporatism economic system. From 1928 on, a law of industrial conditioning was enforced, aiming to limit market competition for manufacturing industries. New companies and production investments required official authorization from the state to ensure market protection for the existing companies. State-protected large private corporations controlled most economic activity. However, new industries that did not have large incumbents, would face fewer restrictions to entry because they would not be seen as threats for the large corporations. This was the case in the molds industry that did not attract the attention of the large economic groups and, therefore, was allowed to grow without major restrictions.

---

4. THE CLUSTER’S EMERGENCE PROCESS (1945 to 1970s)

Once the antecedents of this industry have been scrutinized, this section delves into the emergence process itself and the build-up of clustering.

4.1 Portuguese economy in post-WWII

During WWII, Portugal remained neutral and managed to avoid the destructive impact of the conflict (Pereira and Lãns 2010). The postwar period brought an unprecedented level of sustained economic growth propelled by the industrialization process – with a 3.5% GDP average yearly growth between 1945 and 1960. A massive imports program that secured energy, equipment, and machinery fueled this growth (Lopes 2001). In particular, the import of capital goods was crucial to industrialization, as inputs for production, but mainly as vehicles of technology transfer (Afonso and Aguiar 2004).

At the same time there was an imports substitution policy in the 1950s and an exports promotion policy related to the increasing trade openness after 1960 (Pessoa 2013). It was in the midst of this industrialization effort that the molds and plastics industries were created in Portugal. By then there was a decline in the weight agriculture had in the economy, slowly being replaced by manufacture. Qualified human capital was still a scarce resource as average education levels were low and illiteracy, although decreasing, was still high\(^2\) (Lopes 2001).

The economic growth that characterized the initial postwar period was further intensified from 1960 to 1973, the later so-called “golden years” of economic development for the country. GDP growth rate averaged 6.4%, while occidental Europe was averaging only 4.8% (Lopes 2001).

---

\(^2\) The percentage of illiteracy was 40% for the population over 7 years of age in 1950, decreasing to about 30% by 1960, and about 25% in 1970. By 1990 this percentage was only 5%, however it remained the highest in Europe (Lopes, 2001).
This growth was propelled by physical capital investments and the beginning of a technological catching-up effect, as well as improvements in education (Pessoa 1998).

This accelerated growth occurred in parallel with a strong population decrease due to massive emigration flows – 1.4 million individuals according to Lopes (2001). In an economy that was beginning to open its trade borders to foreign countries (as founding member of OECD in 1948 and EFTA in 1960), there was a generalized strategy to encourage exports, while importing new technologies. The manufacturing industry grew 9% on average in this period (Lopes 2001).

Both large and small companies prospered in this ‘golden years’. In particular, molds companies were predominant in exploiting the export market, mainly to the USA. The country’s pattern of exports changed during the 1960s, when the main share of exports switched from food to manufactured products, with investment products gaining importance towards the end of the century (Afonso and Aguiar 2004).

4.2 The founder: Abrantes

Aníbal Henrique Abrantes arrived in Marinha from Lisbon in 1929, at age 21, to work with his half-brother Roque, who by then had moved back in the region and started a small glass molds workshop (Beira et al. 2007).

In the following decade, the plastics industry emerged in the country. The first company to produce plastic products in Portugal was ‘SIPE,’ created in 1935 to produce electrical material made of Bakelite. An electric engineering professor founded the company (Callapez 2000). In that same year, the firm Nobre & Silva, the first company in the region to become interested in plastics and later convert into that industry, contacted Abrantes with a request to make a few
molds for plastic\textsuperscript{3}. Nobre & Silva started by producing Bakelite lids for perfume bottles, and later added bottle stoppers and ashtrays (Beltrão 1985; Gomes 1998).

In a previous interview in 1949\textsuperscript{4}, Abrantes explained that, at that time, the workshop had a decrease in the number of orders for glass molds (that he feared would lead to personnel cuts) which motivated him to take this challenge and opportunity, albeit not knowing how to produce this type of molds. He recounts that the first mold was far from perfect but was functional enough to be used. The Bakelite powder turned solid when applying compression, therefore the molds for plastic pressing, although different, used similar mechanical principles and technologies to the glass molds (fillers, lathes, and drills) (Beira et al. 2004; Callapez 2000).

The success of these experiments convinced Abrantes to continue perfecting the plastic molds production. However, such experiments were also at the origin of a disagreement between them (Gomes 2005). Roque was, as his half-brother described, ‘passionate about glass’ and did not share Abrantes’ enthusiasm for plastics\textsuperscript{5}. Therefore, Roque returned in 1937 to Oliveira and left the management of the workshop to Abrantes, who was then free to pursue plastic molds.

Abrantes was described by Neto (2014) as a man with a passion for travelling. He would make frequent car trips across Europe, which had a strong influence on his way of doing business. He would buy plastic novelties he found in these countries in order to use them as samples for new lines of molds. He would then visit companies in Portugal and convince them to introduce them. These were products such as plastic combs, bottle stoppers, packaging, toys, and kitchenware. Neto (2014) claims he therefore was not only the founder of the industry in the

\textsuperscript{3} 'Aníbal Henrique Abrantes – O Homem e o Industrial', (1981), Jornal da Marinha Grande.

\textsuperscript{4} 'Uma nova Indústria', (1949), A Voz da Marinha Grande.

\textsuperscript{5} 'Aníbal Henrique Abrantes – O Homem e o Industrial', (1981), Jornal da Marinha Grande.
country, but also the main promoter of the introduction of imitations of most novelty plastic products sold in Europe.

4.3 The pioneer: A.H.A.

By 1945 Abrantes bought his brother’s share in the workshop he was managing and founded, in Marinha, the first Portuguese company (named after himself: A.H.A.) producing the more resistant steel molds for plastic injection molding (Gomes 1998). Abrantes claims in an interview⁶ that he immediately abandoned the production of molds for glass and that his only customer was then Nobre & Silva. However, the firm’s official accounting books seem to imply that the transition from glass to plastics molds was much less abrupt than what Abrantes implied⁷. Nevertheless, in the following year new plastics customers appear⁸ and this percentage goes up to 26%. By 1947 the plastics customers already represented 48%, rising to 72%, then 65%, and 83% by 1950. In this first five years the company had an impressive growth (sales increased by 433%⁹ and the number of employees had doubled by 1953).

Early production techniques at A.H.A., as well as at the first follower companies, made use of very limited technical resources. Neto (1985; 2014) claims that adding to the lack of experienced metal workers in the country, the machinery initially available was very basic. Workers had to use artistic skills coming from the glass industry tradition, as the molds were mostly manually carved in steal at the sight of a sample product. The best workers were often credited by their peers as ‘true artists’⁲⁰ (Matos 2012; Neto 2014).

---

⁶ Ibid.
⁷ There is also evidence of the sale of untransformed goods and services, although these are small amounts.
⁹ In nominal terms.
Due to factors like the innovative task specialization, intense on-the-job training programs, and also because of its strong culture of progress, brotherhood, and self-improvement through constant learning from each other, the company became known in the region as the ‘university of molds’ given its innovative style and the fact that many workers and future entrepreneurs learned about molds while working there\textsuperscript{10} (Gomes 1998; Matos 2012; Rodrigues 2002).

During the industry’s first three decades, common equipment included different types of lathes and milling cutters, broaching machines, pantographs, and manual metalworking tools (Gonçalves and Gomes 2004). Workshops were usually dirty, dark, and messy. However, in 1953 A.H.A. started a new era by inaugurating modern facilities that created a new standard in layout and organization. The contrast to other factories was so big that there were accusations of excess luxury (Gonçalves and Gomes 2004). Both national and local dignitaries participated in the inauguration that was described in local newspapers (Gomes 2005). The new facilities separated different parts of the production process, reinforcing the innovative task division promoted by Abrantes and embodied his strong belief in progress and innovation, which always made him strive to adopt novel technologies as fast as possible – which he closely monitored through his frequent trips abroad (Beira et al. 2004; Gomes 2005; Neto 2014).

\section*{4.4 Internationalization process}

At first A.H.A. relied only on national customers. Companies located nearby in Leiria, or in Espinho (about 140km North) were the main customers up to the mid 1950s. The first foreign

\footnote{10 As also stated in the Conference ‘A Fundação da Indústria na Marinha Grande’ held on 2012/01/31 with Henrique Neto, Joaquim Matos, and Vítor Hugo Beltrão (video available \url{http://cdrsp.ipleiria.pt/historiasdosmoldes/a-fundacao-da-industria-na-marinha-grande}); and in 'História da Indústria na Região de Leiria – Moldes', (2014), \textit{Jornal de Leiria}, Leiria.}
customer in the sales book\textsuperscript{11} is a Spanish company called Hispania, located in Ferrol del Caudillo (Galicia). This seemed to be a single invoice amounting to 63,000 Escudos (3\% of turnover) in 1952 (possibly molds for combs). A second and more significant sale to another Spanish company is registered only four years later (197,000 Escudos to Plasticos Galicia, representing 6\% of the turnover). In that same year, on the 31\textsuperscript{st} of December, there is an invoice to Tony Jongenelen for 38,000 Escudos. In the following year, he became the single most important customer, representing 27\% of sales.

Many sources mention the important role Jongenelen played in the expansion of A.H.A. and perhaps the creation of the cluster itself. He was a Dutch of Jewish ancestry and by the mid 1950s he worked as a commercial intermediary. Before that, and during WWII, he performed with musical groups (e.g. ‘Das Tanzorchester Fud Candrix’) as singer\textsuperscript{12}. Beira et al (2004) and Gomes (2005) claim that his artistic activities were a cover for the his CIA agent\textsuperscript{13} activities, which would help explain the extensiveness of his network of contacts across Europe and the US.

Jongenelen was in Portugal to visit a company (representing a Swiss producer of music box mechanisms) when he serendipitously ran into Abrantes (who was visiting the same company, a customer), and later they established an exclusive export contract. By then the export record of A.H.A. was very limited, therefore Abrantes welcomed the additional orders. In the following year (1957) the exports took off, and by 1960 they represented 77\% of the sales, which had also grown 44\% since 1956, the time the contract started (see Figure 2). The orders brought in by Jongenelen gave this small company in a remote part of Europe a wide access to new markets.

\textsuperscript{11} Most records for the year 1951 are missing, so nothing can be said about this year.
\textsuperscript{12} Some records of these musical performances are still available today (sometimes also under the name Tony Young) – e.g. https://www.youtube.com/watch?v=EEXQeJuaFUM
\textsuperscript{13} These statements were based on interviews and it was not possible to confirm with primary data.
Taking advantage of the relative high quality and low price of the Portuguese molds (Beira et al. 2004; Neto 2014), the deal with Jongenelen allowed the company to tap on the international expansion of the plastics industry. However, this partnership almost drove the company bankrupt, and therefore eventually the exclusivity deal was terminated (Neto 2014). Hence, Jongenelen started working with other molds companies in the region, helping them gain clients abroad, while A.H.A. promoted a young worker, Henrique Neto, to deal with international clients. In parallel, Jongenelen's acquaintances and clients started to visit Portugal in order to buy molds directly, thus broadening the exports to local companies (Gomes 1998).

One particular case is recollected by Matos (2012) in his autobiography: In 1959 he was working for his uncle’s molds firm, ‘Edilásio Carreira da Silva’ – which by then supplied only the internal market – when the company was approached with an order request by Alfredo Brites. This man was from nearby (Leiria) but had relatives in the US who helped him get a job at the American company Hasbro Inc. as interpreter for their purchaser, O’Conner. Although nobody spoke English at the company, after this first successful purchase at a very competitive price for Hasbro, they became regular customers and Matos decided to take English classes.

The involvement of these and other foreign intermediaries14 contributed to a generalized boom of exports, in the beginning mainly to the US market, and transformed the Portuguese molds industry into an international player, exporting nearly its entire output (Gomes 2005).

---

4.5 Spinoff culture

As it grew, A.H.A. soon became a center for worker training and networking, and it also innovated significantly by introducing division of labor. A large number of young workers were trained in specialized areas of mold manufacturing, many of whom later left to start their own companies, taking some of their colleagues with them after their on-the-job learning and training periods\(^{15}\) (Beltrão 1987; Matos 1985). Hence, A.H.A. paved the way for the spawning of a large number of spinoffs (Vieira 2007). Beltrão claimed in an interview\(^{16}\) that Abrantes was an unusual visionary, who knew how to pick employees, and who promoted and supported the creation of new molds workshops by his workers. If their efforts would not succeed, he would employ these workers again. This strategy could have been rooted in his belief that successful molds companies should not be very large\(^{17}\), judging by the average size of the foreign companies he would visit during his travels\(^{18}\); therefore, he would welcome these exits as a way to trim the workforce. Conversely, Neto (2014) reports the first case of a large number of highly skilled workers (five) who left to create their own company in 1958: Somema. According to him, Abrantes received this news with concern, given the impending loss of some of his best workers. Yet, soon he realized that the substitute workers he promoted turned out to be just as good, and in some cases even better. From then on, Abrantes did not hesitate to support the spinoff processes, often subcontracting his ex-workers (as he did for example with Somoplaste).

The successful example of Somema was soon followed by other groups of A.H.A. workers (Neto 2014). Often these teams would include representatives of multiple areas of specialization.

---

\(^{15}\) From 4 to 6 years, as mentioned by Pedro, F. (1985), 'Enquadramento Histórico da Indústria de Moldes', I Congresso da Indústria de Moldes: 19-24.


\(^{17}\) 'Aníbal Henrique Abrantes – O Homem e o Industrial', (1981), Jornal da Marinha Grande.

\(^{18}\) A.H.A. was then allegedly the largest plastic molds company in the world with around 350 workers (Neto, 2014).
(metalworkers, milling operators, lathe operators, technical designers, etc.), where a leader would have to emerge as general manager. Such companies multiplied in the region also because the initial capital investment was low. Neto (2014) remarks that the normal payment conditions in the industry in this period were: one third with the order, one third with the mold test, and the final third upon delivery. It was therefore relatively easy to buy some startup machinery using the initial payment customers made on their orders. In addition, the molds firms in the region, an in particular those startups, would commonly make intensive use of overtime to allow them to reduce delivery times and the working capital investment (Neto 2014). Matos (2012) recounts how he would significantly increase his salary by working overtime, although he had to comply with the employer’s (A.H.A. around 1959) imposition of turning off the lights and use a small table lamp in order to avoid attracting labor inspections. Other authors also report that a small group of skilled workers could start a company with a small investment in used or low-quality equipment and with the support of suppliers or customers (Leitão and Deodato 2005; Silva 1996). In the early days, a rented room with some basic equipment was often enough to start a company. In fact, the critical resources were the working skills and the experience in the industry (Leitão and Deodato 2005). Entrepreneurs would use individual and family resources supplemented by personal credit secured by confirmed orders and the up-front payment by customers or special payment conditions negotiated with equipment suppliers. In some cases the former employer also became a partner of the new venture (Sopas 2001).

Figure 3 provides a partial picture of the genealogy of the first generation of plastic injection molding companies. Arrows between companies represent the spinoff effect (from mother company to spinoff) and companies are depicted regarding their date foundation. The connections between the companies were often intense because subcontracting and sharing
orders to better respond to the customer became common practices in Marinha region (Melo 1995).

FIGURE 3 HERE

Considering that one can trace the origin of a significant share of the Portuguese molds firms to a small group of parent companies located in the same region, the process of growth and expansion of the industry can be compared to the genesis and development of the semiconductor, automotive, and tire industries in the US (Buenstorf and Klepper 2009; 2010; Klepper 2007; 2010). It is well documented that historically the industry grew in the Marinha region through the substantial occurrence of intra-industry spinoffs (Beira et al. 2004; Beira et al. 2007; Gomes 2005; Melo 1995; Rodrigues 2002; Sopas 2001). Moreover, a survey conducted in 1992 to 106 molds companies from Marinha region found that 83% of the company owners worked previously in the industry’s production area (Melo 1995).

The movement of these key pioneers is historically reported as the driver of entrepreneurship and competitiveness in the first years of the industry both in Marinha and also later in Oliveira (Beira et al. 2004; Gomes 1998; Melo 1995; Rodrigues 2002). People who worked or were trained together established long-term relationships that at some point in time would lead to the creation of new molds companies. Several people became entrepreneurs in more than one company, both in this industry and in related industries (Gomes and Soares 2002; Madelino 1996).
4.6 Innovation

The country’s economic and cultural framework had a strong influence in how the industry and the companies, in particular A.H.A., were organized. Traditional toolmakers emerged in the developed countries (like Germany, UK, and US) as a result of the industrialization process in the early 1940s, and they had the skills to perform all the steps of a molds project. However, Portugal had no industrial or technical tradition, and factory owners would simply copy products from abroad, lacking both adequate equipment and skilled technical staff to implement rigorous production methods (Callapez 2000).

Therefore, without those highly skilled toolmakers, Abrantes transformed a weakness into an opportunity to innovate by dividing the work into several parts where workers would specialize, usually associated with different machines (applying Taylorist principles). This innovation permitted worker specialization along the production process (Vieira 2007) and since they could focus on specific tasks, it took less time to train specialized workers than it would to train a fully skilled toolmaker [that could take 20 years according to Neto (2014) compared to just 4 to 6 years, as mentioned by Pedro (1985)]. This innovative strategy helped the industry meet shorter production deadlines and decreased the learning curve. In addition, these specialized workers were less traditional and therefore more open to new production technologies, thus giving the country’s industry more growth potential (Gomes 1998; Neto 1999). Neto (2014) credits A.H.A. as the first molds company to introduce this innovation in the world, and reports that even 30 years later he would find companies across the world still using the much slower traditional artisanal work processes. Division of labor into specialized stages became the norm in the Portuguese molds industry and would be influential in the proliferation of small spinoffs highly specialized in only a few parts of the production process, mostly working in sub-contracts.
Overall, the industry innovated in business strategies and approaches to the market – e.g., introduction of division of labor, low dependency on local customers, and close relationships with key customers (Beira et al. 2004).

Soon the molds became more complex and their production became more demanding. In order to cope with the considerable technological improvements, motivated by demanding foreign customers, the companies in Marinha collectively designed a standard norm for rigorous mold design and project. This resulted from a spontaneous effort done by different individuals that built on each other’s work, and not from a concerted decision of the companies. The process originated at A.H.A. when employees made a short, numbered list of mold parts. Joaquim Matos, at the time working at the firm Edilásio Carreira da Silva as plant manager (from 1959 to 1968), decided to create a quality norm (a combined nomenclature and specification of mold parts) by building on this initial list. He got information about who had access to the list, Henrique Neto, then looked for him, explained his objective, and got access. Matos recounts that he created the systematic technical norm so that all workers could control the quality of the previous task, while the quality of their own work would subsequently be checked by someone else\(^{19}\). When these workers would switch jobs, or create their spinoffs, they would take this norm with them and this helped them ensure quality in the new company. This resulted in the widespread use of this norm in the region, which is still partially being used by companies\(^{32}\). This constant quality assurance improved the production time and minimized errors; therefore it enhanced the companies’

competitiveness. Matos (2012) says he was inspired by the tradition of checking each other’s work he had learned while working at A.H.A..

5. CLUSTER’S GROWTH AND SOLIDIFICATION (from the 1980s)

In order to gain an understanding of the cluster’s emergence process we should take a wide temporal framing that includes not only the antecedents of this process but also the subsequent developments, as suggested by Danto (1965). Observing the patterns and structures that arise or subsist after the cluster’s emergence process will help understanding the path-dependence linkages and to think more clearly about causality (as suggested by: Wadhwani and Bucheli 2014; Wadhwani and Jones 2014).

5.1 Confirmation of the cluster’s potential

After the initial advent of the molds cluster there was a demand boom due to the outburst of applications of plastic materials in electronics, starting in the late 1970s and substantially increased in the 1980s and 1990s, a time when new molds companies would emerge ‘overnight’ (Henriques et al. 1991).

As production became complex and competition increased, commercial capabilities gained a critical role. Companies were compelled to improve such capabilities, which in the early days were mostly neglected given the focus on production. Therefore, while the first wave of spinoffs (until the 1970s) was headed by workers with extensive production know-how, the second wave (from the mid-1980s) was championed by workers either from commercial departments, with knowledge about markets and customers, or design departments, working closely with customers
to ensure conformity to their needs (Oliveira 1996). This trend drove the industry further into vertical disintegration, with fewer companies involved in all the value-adding activities, and more companies specialized in parts of the process (Oliveira 1996).

The main factors contributing to the export boom in the Portuguese molds industry during the 1980s and early 1990s were the increase in international demand for molds (due to the explosion of applications for plastic products in the industrialized world) and the industry’s low prices when compared to competitors’ average prices. The prices were low because wages were lower than in other industrialized countries and because there was a policy of rolling devaluation of Portuguese Escudo against US Dollar.

During the 1980s some companies would get requests for quotations just because they were located in Marinha (Sopas 2001). The location facilitated random contacts of customers attracted by the concentration of specialized firms. Industry concentration may also have produced a demonstration effect due to the presence of successful companies that could contribute to lowering the perceived entrepreneurial risk and stimulate further entry through imitation (Porter 1998). Entrepreneurs in the molds industry mentioned that the fact their colleagues had already succeeded with their spinoffs provided an incentive for them to do the same (Sopas 2001).

Companies reported advantages to locating in Marinha, related to easier access to subcontracts from other local producers or from traders (Sopas 2001). However, it can be argued that these advantages are also linked to the fact that the entrepreneurs were previously working in the region and in the same industry. Yet other reported advantages associated with location included the increased likelihood of being visited by foreign customers attracted to Marinha and the support of specialized organizations like the region’s training centers (Sopas 2001).
5.2 Technological change

The modern molds plant requires heavy reliance on advanced software and machinery increasingly based in information technologies. The industry was a pioneer in the country during the early 1980s in the adoption of advanced industrial technologies (Henriques 2008). Neto (2014) attributes the cluster’s strong proneness to innovation to the legacy of A.H.A.’s cultural tradition.

In the late 1970s, a first round of investment in new-generation technologies began with the acquisition of programmable key-in machines. Such investments aimed to improve productivity and gain capacity to produce more demanding product specifications that were progressively less linear (Beira et al. 2004). Numerically controlled equipment and machining centers followed, but such expensive investment required high usage rates. Considering that production series are very small (usually one single product), this would require intense programming. Yet, programmers were hard to find in the market, very costly to train, and harder to keep due to their scarcity (Beira et al. 2004).

Early on, the industry became aware of the potential of CAD/CAM technologies, and in 1983 this was one of the main topics discussed in the first conference of the molds industry, voicing the concerns and expectations of the businessmen (Alfaiate 1985; Neto 1985). Clients were also pushing for the use of CAD files to send the description of the product in quotation requests (Beira et al. 2004; Neto 1987a). However, the introduction of programmable machines, and later CAD/CAM/CAE and NC systems, brought new production management challenges.

In the first few years of the industry, Abrantes had solved the problem of lack of skilled toolmakers with division of labor. This approach was also useful later on, when new production technologies were introduced because employees were less resistant to new ways of doing their
work, due to their specialized and less traditional profiles. However, the introduction of CAM systems and automated production technologies implied a shift in workflow organization, and most companies were not up to the challenge. Although CAD/CAM technologies were introduced very rapidly and were considered almost mandatory in the Portuguese molds industry in the early 1990s (entrepreneurs felt a generalized social pressure to adopt new technologies (Neto 1987a)), the way to organize work remained essentially the same. Therefore the corresponding productivity increases would often not materialize and human resources problems would arise (Alfaiate 1987). Traditionally the industry relied more on empirical, skill-based problem-solving and improvisational techniques performed by workers with low education levels (Neto 1993). To some extent, thinking was separated from implementing due to the low education level of the workers (Neto 1993) and also, in the early days, to the desire to protect production from possible worker rebellions and union fights. Therefore design had been removed from the shop floor to the white-collar areas (Beira et al. 2004).

The new technologies required more planning and a higher investment in verification and programing prior to manufacture. Also, in order to make equipment profitable companies had to make sure that occupation rates were high, which also required a better workflow planning effort (Neto 1987b). New technologies also required a better understanding of the entire production process by all workers. It was no longer easy to separate different tasks because machine programing required knowledge about materials, technical drawing, machining, and an understanding of the production flow (Neto 1987a; Pires 1989; Sousa 1987).

In the case of CAD/CAM some companies proceeded to adopt the technology even without fully assessing the return they could obtain from such high investment, and without fully researching the adequate specifications or planning how to adapt the work flow to reach the
equipment’s full potential (Neto 1993; Pires 1989). Not many companies understood the need to break from the traditional management model implemented in the industry (Alfaiate 1987; Neto 1993; Rodrigues 1989). In fact, in the third conference of the molds industry, held in 1988, the minister for industry recommended that companies should moderate their enthusiasm to adopt advanced technologies (Amaral 1989).

According to worldwide industry statistics, the Portuguese molds industry ranked high in investment but low in productivity per employee (Neto 1993; Pires 1989). The productivity problem became a major concern for the industry, and the prescribed solution was often based on education and training for workers and managers (Santos 1989).

Technological investments allowed the industry to upgrade into more sophisticated markets. The first customers in the 1960s were from the toy industry, which at the time was not particularly demanding in terms of quality, and prices were not high. The industry’s target markets evolved into the precision molds segment. Often for electronics and automotive industries, where molds have very small tolerance levels (a few microns) and therefore require high technological sophistication in the production processes (Gomes 1998).

5.3 Industry organization

Portuguese molds companies are in general very small. A company with 100 workers is considered large (Henriques 2008). Each mold is a new, unique project, and a unique combination of standard components (for instance, heating and cooling systems, and injectors) and non-standard components (for instance, specific molding surfaces). This degree of customization and specialization limits scale economies and emphasizes worker qualification and
experience (Gomes 1998). The industry is composed of a multitude of small and micro firms specializing in specific types of molds and, often, in specific stages of the vertical integration chain. This structure is very close to the Italian textiles and ceramic clusters in Emilia Romagna (Brusco 1982; Porter 1998).

Due to the growing demand and competitive prices, in the early days the companies did not need to make intense commercial and marketing efforts. Traditionally they depended on intermediaries or just the local industry’s reputation to get requests for quotations (Gomes 1998). Most companies were production-oriented (Sopas 2001) and lacked knowledge about the market and how to select and reach customers.

The molds production process involves several stages, constant testing and customer feedback, and frequent alterations (Mota and Castro 2004). Fulfilling orders typically involves a multiplicity of firms sub-contracted or outsourced to accomplish key parts of the production process, such as designing, machining, or thermal treatments. Subcontracting is a pervasive behavior among Portuguese molds companies (Henriques 2008; Sopas 2001). Sometimes new firms would start by working on orders from the former employer of the entrepreneur(s), although some companies started by working for foreign customers that the entrepreneurs knew from the former employer where they had a work relationship (Sopas 2001).

In such a community of vertically disintegrated firms, the ability to coordinate competencies and combine knowledge across corporate boundaries (but inside regional borders) has become a distinct capability itself. Managers develop a specialized supplier network and build a narrower and more competitive set of core competencies, being capable to rapidly locate and contract specific external competences from other firms located nearby.
Very few Portuguese molds companies have chosen to extend their boundaries, vertically integrating marketing, design, and various stages of production. Some of the more successful marketing/engineering firms may keep connections with as much as 70 molds producers and 10 designers simultaneously (Mota and Castro 2004). Under these circumstances, knowledge acquired about the strengths and limitations of local firms, capabilities (for communication with different professionals, and transmission of specific knowledge, technologies, routines, and product designs) are instrumental for success. More likely, access to networks of multiple producers has provided greater flexibility than vertical integration.

6. DISCUSSION AND CONCLUSIONS

The aim of this paper is to deepen our understanding of the cluster emergence process by embracing its complexity and by using the historical lens to dissect dominant factors. Therefore, cluster formation is historically contextualized and multiple perspectives and levels of analysis are used to get a richer and clearer picture of the choices and actions of individuals, firms, the industry, and the region, and to apprehend their motivations and effects.

The analysis resorted to multiple primary and secondary data sources including company accounting records, interviews with entrepreneurs and institutions’ representatives, reports and testimonies from entrepreneurs and prominent workers, industry magazines, reports from industry congresses, autobiographies, local newspaper articles, and also books, papers, and theses by historians and economists. The data collected covers a period that ranges from the late 18th century to current times.
The paper focuses on the plastic injection molds cluster located in Marinha, in Portugal, which has the core characteristics of a typical ‘industrial district’ composed of networks of small spatially concentrated companies. This industry has very limited scale economies and tacit knowledge was of major importance, especially in the early years. This case is interesting because it depicts a successful cluster from an understudied context (Portuguese firms).

The paper is anchored in three different theoretical perspectives that contribute to explain industrial clusters. Agglomeration economies justify the existence of industrial clusters with the rational decision by the entrepreneurs to locate in the cluster due to the positive externalities available only in that area, and that positively impact the company’s performance. The heritage theory defends that the build-up of companies in one location results from an endogenous spinoff process and from the entrepreneurs’ preference to remain in their home location. Both theories highlight the role of entrepreneurship in the emergence process but they attribute different causes to that dynamic. Moreover, both theories focus on the rational decision-making dynamics of the economic agents and fail to fully consider the role of institutions in the creation and development of a cluster. Although such economic reasoning is certainly very relevant to the story of cluster emergence, there may be room for additional and parallel explanations associated with the institutional setting of the cluster (including the culture, the organizations, the traditions, etc.), which require a richer and complexity-enabling research approach.

When looking at the antecedents of the molds cluster’s emergence, factors such as technological change, precursor industries in the region and their effects, and the economic context in the country were considered. By looking at a period ranging from the mid 18\textsuperscript{th} century until the end of WWII it became clear that there were strong path-dependencies leading to the appearance of molds for plastic in Marinha. Some level of technological closeness in the initial
stage and the potential substitutability of glass by the new plastic materials could motivate the interest in this very new industry. However, this association to precursor industries is not novel, and only confirms what the heritage theory had already pinpointed [as in the example of the automotive industry in the US which was initiated by companies operating in the bicycles, engines, carriages, and wagons industries (Klepper 2001)]. More noteworthy is the additional finding about the pre-existence in the region of a considerable supply of industrial workers. Although these workers had very distinct backgrounds from what would be required by the plastic molds industry (namely a more artistic than technical inclination), the presence of this resource proved later to be very useful to the emergence of this new industry. Nevertheless, it would be difficult to argue that this availability of skilled labor would be the main driving factor for the emergence of the cluster, it is more logical to regard it, not even as a necessary condition but an enabling factor (the Silicon Valley cluster reportedly emerged in a region where there was no particular availability of workers, as it was a rural region, where the pioneer entrepreneur’s mother lived). Conversely, the particular culture of the region was distinct: there was an ‘aristocratic proletariat’ culture that valued education and civil and political awareness, and promoted the legitimate ambition to improve social position. This culture was also linked to a strong local entrepreneurial tradition that rose from the Stephens brothers’ glass company. Such culture was unique to this region and seemed to have a strong imprinting as it prevailed during and after the cluster’s emergence process. It can be logically argued that this institutional setting had a significant effect in the openness to invest in a new industry and in the subsequent entrepreneurial spur in the cluster.

The industry emerged in the beginning of what would be called the ‘golden years’ of economic prosperity in the country, which provided a generally favorable context. Abrantes
seemed to fit very well in Marinha’s cultural norm. His decision to experiment with the new industry was initially an attempt to mitigate a crisis in the demand for glass molds but he soon developed what was described by him, and others who knew him, as a ‘passion for plastics’ and a vision of the potential of what at the time was only a possibility and not yet an industry. Nonetheless, he transitioned slowly from the glass molds industry into the plastic molds industry, while at the same time playing a very active role in promoting the application of plastic materials in Portuguese companies, by making them aware an interested in the novelties coming from other European countries (as a result of his frequent car trips in the continent). The pioneer company introduced significant innovations (not in the product itself but rather in the production process), which had a very strong impact in the competitiveness of the company internationally. This was soon discovered by a commercial agent, Jongenelen, who quickly tapped into this arbitrage opportunity. The ensuing internationalization, taking advantage of favorable export economic conditionings, which offered a huge market expansion opportunity, and the prolific spinoff process led to the appearance of the molds cluster in Marinha.

The interpretation of these findings in view of the theoretical framework would lend support to the heritage narrative founded on the spinoff mechanism. The bulk of the entrepreneurs in the emergence stage came from the region and had experience in the local companies. The narrative of the spinoff effect seems to be founded on the institutional setting of the region: the entrepreneurial tradition with plenty of role models and the strong legitimacy of such ambitions.

There is no evidence or suggestion of existence of knowledge spillovers in the region. On the contrary, tacit knowledge did have a primordial role but was commonly transferred embodied in the workers and entrepreneurs (as in the case of the nomenclature norm described). During the emergence process, there are no records of successful entrants who did not come either from the
spinoff mechanism or as diversifier spinoffs from the precursor glass industry. There are also no narratives or indications of entrant location choices motivated by the presence of specialized suppliers – this was not the case in the early years. The argument about pooling of the labor market is less clear. It would be reasonable to think that entrepreneurs in the early days would want to hire from Marinha’s pool of specialized workers, with either knowledge from the glass or plastic products. However, the entrepreneurs seemed to rely heavily on their personal networks when teaming up to spinoff or to switch jobs (family ties or ex-work or school colleagues). Transportation costs to customers were also not significantly lower inside the cluster, as those were either spread out through the country or abroad. In the case of A.H.A. the main domestic customers prior to the internationalization were located in Espinho and Leiria.

Although the narrative gives support to the heritage theory, it seems also clear that this theory does not explain the process fully. Institutions play here the central role and the path-dependence can be very clearly identified and a main driver of the clustering process. Furthermore, the analysis of the growth and solidification period confirms the importance of the initial conditions and the path-dependence prevalence. Beholding the persistence of the innovation tradition and fast technology adoption it is clear that it derives from the A.H.A. role model imprinting and from institutional isomorphism. The first entrepreneurs observed examples (role models) of successful spinoffs and the tradition of support of the incumbent to those spinoffs (e.g. Somena), in a framework of low barriers to entry and expansion of demand. Therefore, this spinoff norm would tend to prevail in time and lead to the persistence of the cluster’s strong entrepreneurial culture.
REFERENCES


Sorenson, O. and P. Audia (2000), 'The Social Structure of Entrepreneurial Activity:
'Uma nova Indústria', (1949), *A Voz da Marinha Grande*.
Figure 1 - The location of Marinha in Portugal

Figure 2 – Sales and exports of A.H.A. (nominal values)
Figure 3 – Sample of the genealogy of plastic injection molding firms in the period 1946-1989
(Based on information from: Beira et al., 2004; Gomes, 1998; Gomes, 2005; Lopes, 2004; Rodrigues, 2002; Silva, 1996)