
Technological Innovation in Industrial Districts in Spain During the First Third of the 20th Century*

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Industrial districts and technological innovation

This paper deals with the innovative capacity of Spanish industrial districts in the early stages of its development, in the late 19th and early 20th century, and with some factors that impacted significantly on it.

According to the works of Alfred Marshall, the theory of industrial districts states that firms attain greater efficiency in these clusters of production, and that this forms an essential component of their competitive advantage.¹ It is what Signorini (1994) called the “district effect” and what Schmitz (1995, 1999) has described as “collective efficiency”, noting that it is a characteristic that depends not on each individual company, but on the territorial system

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1. The concept of “industrial district” is not always used with the same meaning. In this study, following the proposal by Zeitlin (2007), the term industrial district is defined as Marshall originally intended it, “as a geographically localised productive system based on an extended division of labour between small and medium-sized firms specialised in distinct phases or complementary activities within a common industrial sector”. It is, therefore, a more open concept than the canonical model of the neo-Marshallian or Italian district, which incorporates other features of a social and cultural nature (Becattini, 1989). Furthermore, the terms “industrial district” and “cluster” are often used as synonyms, but they are concepts that do not have exactly the same meaning. As pointed out by Porter (1998), p. 78, “clusters are geographic concentrations of interconnected companies and institutions in a particular field”, regardless of company size and degree of fragmentation of the production process. Therefore, the term “cluster” has a broader meaning than the term “industrial district”. All industrial districts are clusters, but not all clusters can be considered industrial districts.

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to which it belongs. Much research, carried out mainly in Spain and Italy, has found quantitative evidence of this district effect in the form of increased productivity and profitability of firms, and even an increased export capacity.

Marshall attributed the advantages that firms find in districts to three kinds of external economies generated by companies from the same sector clustering together: firstly, the existence of a series of complementary activities, providing inputs, services and capital goods; secondly, the availability of a specialised labour market; and finally, the accumulation of specific knowledge on the sector and the ease with which specialist information is transferred between firms. Becattini and other Italian authors who have built the canonical model of the neo-Marshallian industrial district add two new elements to these sources of competitive advantage: flexibility in production provided by the system of interrelated small and medium-sized firms, and the existence of a social, cultural and institutional environment that brings down transaction costs, fosters cooperation between businesses and facilitates collaboration from institutions with businesses.² The importance of flexibility in production for industrial districts has been pointed out by other authors, such as Piore and Sabel, and followers of “flexible specialisation”, whereas the value of institutional support has been highlighted by Porter’s analysis of the competitive advantage of clusters.³ Another cause of the “district effect” that appears in the literature is the capacity for technological innovation made possible by industrial agglomeration. Although this feature was mentioned by authors in the 1970s and 1980s, and does in fact appear to have been suggested in the technological externalities of which Marshall wrote, it has acquired greater prominence since the 1990s, when much of the economic literature considered innovation as a key determinant of competitiveness. For Becattini, industrial districts can be thought of as a “creative milieu”, where a continuous recombination of technological stock generates “both a constant stream of innovations from the bottom upwards and a stimulation of the tendency to innovate”.⁴ This same idea, which establishes continuous innovation as an intrinsic characteristic of industrial districts and clusters, is found in many other authors,⁵ and many other works empirically show the positive relationship that the territorial concentration of industry has with knowledge transfer and generating innovation.⁶

2. Catalan, Miranda & Ramon-Muñoz (2011).

3. For flexible specialisation approach, see Piore & Sabel (1984), Sabel & Zeitlin (1985, 1997), Scott (1988), and Storper & Scott (1988). For Porter’s approach, see Porter (1998, 2000).

4. Becattini (2004), p. 46.

5. For example, Piore & Sabel (1984), Bellandi (1989, 1996), Porter (1990), Harrison (1994), Camagni (2003), and Cainelli & De Liso (2006).

6. Among others, Audretsch & Feldman (1996), Molina-Morales (2002), Gabaldón, Fernández & Tortajada (2005), Cainelli & De Liso (2006), Lazzaretto & Capone (2009), Expósito, Molina & Capó (2010), Molina, Ares & Molina (2010), and López Estornell (2010).

Faced with the vision that prevailed up to the 1980s, which considered industrial districts as technologically backward areas, with firms of insufficient size to invest in R&D and which were therefore at a disadvantage in terms of generating innovation, these authors consider that clusters of small and medium-sized firms actually facilitate and foster technological change, due mainly to knowledge spill-over. Accumulating specialist knowledge and ways to transfer ideas and information provided by geographic proximity and by direct and frequent contact between technical managers of different businesses is described as an efficient mechanism of innovation. The evolutionary literature states that knowledge accumulated in districts has a tacit, informal nature, which is closely linked to the context in which it is generated, by means of the processes of “learning by doing” and “learning by using”. According to this approach, any innovations that do occur are mainly incremental, but this does not prevent, and may even help, firms to increase their productivity and secure greater competitive advantages than innovations generated by investment in R&D and codified knowledge.⁷

The existence of technically prepared labour, the specialisation of firms in certain stages of the production process and the presence of a dense network of providers of intermediate goods, services and machinery also prove to be a favourable framework for developing new products and production processes in territorial and sector-based clusters of businesses. Constant interaction between different agents in the district, including institutions, makes it possible to combine resources and capacities that would not normally be available to an individual business, as well as reducing uncertainty and risk from innovation. Furthermore, the advantages of interaction between different companies is increased by the possibility of collaborative relationships being formed, particularly of vertical cooperation between companies that produce capital and intermediate goods with firms that use these goods. Firms have the incentive to innovate because of the strong competition that exists within the districts, which leads to continuous attempts to differentiate their products and improve the efficiency of their processes⁸.

It is difficult to measure the level of technological innovation achieved in territorial clusters of small and medium-sized firms, precisely because tacit, contextual knowledge and incremental innovations, often developed by means of informal mechanisms of interaction and cooperation between companies,

7. Belussi & Gottardi (2000).

8. Gordon & McCann (2005). On the importance of social capital for innovation in industrial districts and clusters, see Cainelli, Mancinelli & Mazzanti (2005), Molina, Ares & Molina (2010), and Casanueva, Castro & Galán (2010), for example. On the positive effects of strong competition within the districts, Enright (1995) and Porter (1998). López Estornell (2010) includes an excellent state of the issue of different interpretations regarding innovation in industrial districts.

predominate in firms of this kind.⁹ These forms of innovation are poorly reflected in the main indicators used to measure technological capacity, both those that are based on the inputs used in the innovation process (chiefly investment in R&D and number of researchers) and those that rely on outputs (patents and other records of industrial property). These indicators are much more suited to innovations generated in the R&D departments of large firms and in research centres, and tend to underestimate the technological progress that occurs in the systems of small and medium-sized firms. Patents are the most commonly used indicator, due to the amount of information that they provide, the broad range of sectors that they cover, and because, due to the similar nature of industrial property regulations in most countries, it is easy to make international comparisons.¹⁰ The fact that patents have been registered since the 19th century, and even earlier in some countries, makes them an essential indicator for studies with a historical perspective.¹¹ However, patents imply a step from contextual to codified knowledge, which often does not occur in small and medium-sized firms.¹²

Boix and Galletto have compared the capacity for innovation of Marshallian industrial districts with that of other forms of local production systems in Spain.¹³ Despite the problems of patents to provide a faithful reflection of technological progress in the systems of small and medium-sized firms, their work uses patents as indicators of innovation and shows it to be greater in industrial districts than it is for the country's average and even greater than in the manufacturing production systems of big businesses.

Building on the research of Boix and Galletto, the aim of this paper is to determine whether the high level of technological innovation detected nowadays in Spain's industrial districts is, as the theory states, an intrinsic characteristic of these districts that was present in all stages of their evolution or, on the contrary, it is a recent reaction to changes that have occurred in global markets and technology over the last decades.

9. Bellandi (1996).

10. Griliches (1990).

11. McLeod (1988), Sokoloff (1988), Lamoreaux & Sokoloff (1999), Ortiz-Villajos (1999), Sáiz (1999).

12. It must also be taken into account that not all innovations can be patented and not all sectors and not all types of business have the same tendency to file patents. On the other hand, there can be large differences in economic impact between different patents. See Pavitt (1985, 1988) and Desrochers (1998).

13. Boix & Galletto (2009).

The industrial districts of Spain in the first third of the 20th century

The work by Boix and Galletto first identifies existing local labour markets in Spain by using data on travel-to-work commuting from the 2001 population census. Having established these territorial units as reference points, the methodology used by Sforzi and Italy's Instituto Centrale di Statistica is then applied to identify industrial districts as local work systems that specialise in manufacturing, where there is a predominance of small and medium-sized firms and where the main industry is made up chiefly of small and medium-sized companies. According to this method, there are 205 Marshallian industrial districts in Spain, which make up a quarter of all local production systems in the country. Most of these districts are involved in manufacturing products for the home, the textile and clothing industry, the food industry, leather goods and footwear. Geographically, the districts are mainly located in the Region of Valencia (26% of districts and 66% of employees working in districts) and Catalonia (16% and 28%, respectively).¹⁴

Boix and Galletto use the data for patents registered by residents of Spain from 2001 to 2006 to calculate the level of innovation in industrial districts and compare this level with that of the other categories of local production systems. The result is that the set of Marshallian districts has an annual average of 333 patents per million employees during the period studied, a ratio that is much higher than the mean for the country as a whole (230 patents per million employees), but which is also higher than the mean for the manufacturing systems of large firms (with 256 patents a year per million employees) and the core of the largest metropolitan areas (288), and much higher than the mean for local systems in services (221), agriculture (88) and construction (109). Therefore, industrial districts contained 21% of jobs for the period in question and generated 30.6% of Spanish patents. Furthermore, 57% of the districts showed a ratio of innovation above the national mean.¹⁵ Boix and Galletto back up this increased capacity for technological innovation in industrial districts with the statistics for patents filed in 1991-95 and 1996-2001. The average number of patents was 33% higher than the national average during the first period, and 35% higher in the second. This difference in favour of industrial districts is also observed, to an even greater extent, when considering other indicators of innovation, such as records of industrial designs and models, and grants and credits provided by the Centre for Industrial Technological Development, a public organisation that answers to the Ministry of Economy and Competitiveness, which channels requests for funding and support for R&D&I projects by Spanish firms. By using an econometric

14. Boix & Galletto (2006, 2008).

15. Galletto (2008); Boix & Galletto (2009).

model, the two authors conclude that the increased level of innovation in districts (what they call the “I-district effect”) relates chiefly to Marshallian economies of localisation “as specialization, the existence of a specialized pool of manufacturing workers, specialized suppliers and social capital”.¹⁶

The work of Boix and Galletto seems to confirm the high capacity for technological innovation that the theory attributes to industrial districts and shows that this capacity manifests itself even through indicators of codified knowledge, such as patents. However, it should be remembered that their research uses data from recent decades, as occurs with other empirical studies of innovation in the systems of small and medium-sized firms. From the 1980s onward the rapid integration of the world market and technological development had a strong impact on industrial districts.¹⁷ Districts which in many cases specialised in labour-intensive industries had to compete with products from countries with much lower labour costs, eroding their price competitiveness. On the other hand, the competitiveness that came from districts being flexible in their production structure was reduced because technological advances also allowed for flexibility in the production systems of big firms. This new economic environment forced industrial districts to strengthen their competitive advantage with greater recourse to innovation and product differentiation, with the emphasis on using and generating codified knowledge. This was a response that was encouraged and supported in Spain and other countries by public policies, particularly among regional authorities.¹⁸ It is not known, therefore, if the capacity for technological innovation in industrial districts as shown in studies from recent decades is simply how such districts respond to the challenges of the “third industrial wave”,¹⁹ or if, as the theory suggests, it is indeed indicative of an inherent characteristic of these economic formations, which has formed the basis of their competitive advantage throughout their history.

The objective of this study is to answer that question, by examining technological change in Spanish industrial districts during the last decades of the 19th century and the first third of the 20th century. In this period a significant number of the main industrial districts that are still in existence had already formed. The start of the period selected, 1878, coincides with the moment when, due to the change in regulations, lowering the rate at which inventors were taxed, the number of patents filed in Spain grew noticeably.²⁰ The period ends in the mid-1930s when the economic environment changed radically as a result of the Spanish Civil War, followed by the autarky of the Franco era.

16. Boix & Galletto (2009), p. 1130.

17. Costa, Duch & LLadós (2000).

18. López, Mas & Molina (2008); Ponce (2004).

19. Bellandi (2007).

20. Ortiz-Villajos (1999); Sáiz (2005).

The districts to be analysed were chosen from the list of Marshallian industrial districts identified by Boix and Galletto. This list was ordered by the number of workers in the district's main industry, and the first ten districts were chosen that were still operational today and which the literature can safely characterise as sector-specific and territorially concentrated, with a predominance of small and medium-sized firms, prior to the outbreak of civil war.²¹ Five of the selected districts (Alcoy, Elche, Elda, Ibi-Onil and Onda) are in the Region of Valencia. Four are in Catalonia, in the province of Barcelona: Igualada, Manresa, Mataró-Calella and Sabadell. There is also one district, Eibar, in the Basque Country. All these districts have a long history, and have had to deal with very different situations and adapt to continuous changes in the markets and in technology, arriving at the present with a prominent position in their respective industrial specialities. They are, therefore, examples of long-term success. Although districts do not often respect municipal limits and can stretch across more than one town, not enough information is available about the past to allow this study to take this aspect sufficiently into account for all cases, so the districts are identified by the main town that they are in, except for Foia de Castalla (Ibi and Onil) and the Maresme (Mataró and Calella), for which, due to reasons given further below, two municipalities are used to describe a single district. The geographic spread of the districts chosen follows the same pattern that can be seen in the map of Marshallian industrial districts in Spain obtained by Boix and Galletto using the Sforzi-ISTAT method, with most of the districts located in the Region of Valencia and Catalonia.

There are also similarities in industrial specialisation between the sample used in this study and the industrial districts identified by Boix and Galletto. In both cases, there is a predominance of labour-intensive industries specialising in consumer goods, with a notable level of participation from the textile and clothing industry and the footwear sector. In the sample used for this study, all the districts in Catalonia and the Alicante district of Alcoy are in the textile and clothing sector, and the Elche and Elda districts specialise in footwear. However, the strong presence of products for the home in the industrial districts as they are today is only reflected for the early part of the century in the Onda ceramic tiles district. The mechanical industry is represented by the firearms district of Eibar, and the toy industry by the district of Ibi-Onil.

21. Unlike the criterion followed by Boix & Galletto (2006), and in accordance with Ybarra, Santa María, Giner & Fuster (2008) and with López Estornell (2010), Valencia was not considered as an industrial district because, as pointed out by López Estornell, Valencia is a large city with many different activities and closely linked to its metropolitan area, the economies of urbanisation are as influential as those of localisation, and a leading industrial branch cannot be clearly distinguished.

Most of the Catalanian textile districts were already well developed by the start of the 20th century. Sabadell, a town in the Vallès Occidental area of Barcelona province, next to the Ripoll river, where the largest district in this group developed, has specialised in producing woollen fabrics since the 18th century. By the middle of that century, the district had already undergone the transition to a modern enterprise, and by the century's end the activity employed a third of the area's population. In the early decades of the 19th century the industry's mechanisation began, and steam power was introduced in the 1840s. A Marshallian industrial district developed, where "next to the large manufacturers there coexisted small and medium manufacturers and industrial firms specialising in particular stages of production".²² In fact, companies involved in the entire cycle of production were in the minority, and in the 1860s represented less than 30% of all spinning and weaving firms in the district. In the mid-19th century, the textile sector employed more than half of the male population over 15 years of age and almost 70% of the female population, and growth continued in the following decades with increased specialisation in wool, to the detriment of cotton. Sabadell actually formed part of a broader wool district that existed throughout the Vallès area, with another prominent centre in Terrassa. In both centres a flexible, industrial organisation developed, based on market cooperation to obtain energy, the availability of facilities and vertical specialisation. However, Sabadell was characterised by greater flexibility in production, due to the small size of businesses and the greater specialisation of companies in different stages of the production process.²³ In the last quarter of the 19th century, the Sabadell-Terrassa district and its business network became the main production centre for the wool industry in Spain.²⁴ Industrial expansion was accompanied by spectacular demographic growth, which was helped by immigration from neighbouring areas with a textile tradition, and by 1900 Sabadell had the fifth largest population in Catalonia.²⁵ From that point on, the economic and political changes that the town underwent were led by the great wool patriciate.²⁶ The industry continued to grow in the first third of the 20th century, and by the end of the Spanish Civil War there were more than 400 businesses and 15,000 workers employed in Sabadell's wool sector.²⁷

In the Bages region where the Llobregat and Cardener rivers meet, half-way between the city of Barcelona and the Pre-Pyrenees, the town of Manresa developed an industrial district in the second half of the 19th century spe-

22. Benaül (1992, 1995), p. 217.

23. Benaül (1994).

24. Deu (1990, 1994).

25. Camps (1997).

26. García Balañá (2003-4).

27. Calvet (1994).

cialising in cotton textiles.²⁸ In the middle of the previous century, textile production had been mainly in silk, with significant wool production as well, but it was the cotton sector that was to become the more dynamic force, due to investment from entrepreneurs and capital from the silk trade.²⁹ The growth of textiles led to the development of other auxiliary and complementary industries, such as metallurgy, wood and chemicals. By the beginning of the 20th century, Manresa was one of the five largest towns in Catalonia, with 25,000 inhabitants.³⁰ After the Civil War, the town's textile sector came to a technical standstill, although it remained the district's economic mainstay. In the late 1940s, the industry employed almost half the active population in the local region, with textiles making up almost 70% of the district's industrial assets, and metallurgy around 11%.³¹

In the second half of the 19th century, a dynamic industrial district specialising in woollen garments developed in the Maresme area on the coast of Catalonia approximately 30km from the city of Barcelona, with the main centres located in Mataró and Calella. The district has its roots in the long-standing textile tradition that existed in the area, which provided a skilled female workforce, and in good transport links, particularly with Barcelona, which were further improved with the construction of the railway, although it was the desire of the wool firms in the area to modernise their techniques that helped the district to consolidate and become the main cluster for the sector not just in Catalonia but in Spain as a whole. Mataró was the pioneering town and led the way in mechanisation: circular looms were already in use by the mid-19th century, with batteries becoming widespread by the 1860s and steam power in general use by the 1870s. In the last two decades of the 19th century, the industry modernised throughout Calella and other towns in the area. The growth of the sector led to a rise in other auxiliary activities, such as spinning, finishing, the manufacture of containers, machinery and repairs, etc., which helped to strengthen the district's position. In 1915, wool firms made up 60% of the taxable revenue in Mataró due to the third-level rate of Industrial Tax (for manufacturing), and the region provided more than 30% of Spain's production in the sector; eight years later, this proportion had risen to 40%. In the 1920s and with the spread of electricity, foreign technology was increasingly incorporated, helping to increase productivity and improve the quality of the product and diversify production. Although there was a predominance of small and medium-sized firms, there were some large businesses, particularly in Mataró, where of the total amount of Industrial Tax paid

28. Oliveras (1985, 1986).

29. Ferrer (1986, 2004); Muset (2002); Solà (2004).

30. Llusà (2002).

31. Virós (2009).

by the 73 companies registered in the sector in 1922, more than three quarters was paid by only seven firms.³²

The other Catalonian textile district included in the study is Igualada, a town in the centre of Catalonia and strategically located where the main route between Barcelona and inland Spain met the route linking the Pyrenees with the Campo de Tarragona. The district's specialisation in textiles dates back a long way, just as it does with the other districts from this sector analysed in this study. The manufacture of woollen fabrics was the main activity in the area as far back as the 17th century, and by the middle of the following century Igualada had become one of the largest centres of the wool industry in Catalonia. Growth in this activity was accompanied in the 18th century by cotton spinning and leather tanning, leading to the town's population multiplying by four over the course of the century.³³ The wool trade fell into decline in the early 19th century, but cotton manufacturing began to enjoy significant growth, and Igualada's cotton spinning industry became the second largest in Catalonia in terms of production, exceeded only by the city of Barcelona. By around 1850, the spinning industry (in which most machinery was operated manually) employed almost 1,500 workers, and more than 2,300 people worked in the weaving industry. In the second half of the 19th century, the Igualada cotton industry suffered as it struggled in the mechanisation process due to a shortage of water resources, the high cost of transporting coal from the port in Barcelona and the delayed arrival of the railway. This led to a major industrial crisis in the town, the population of which in 1900 was 25% lower than in 1857, and would not exceed 14,000 inhabitants from then through to 1936. However, the leather industry continued to grow, whereas the textile sector, helped by the arrival of the railway in 1893, electrification and the advantage of lower wages than in other industrial towns in the region, began to recover in the last decade of the 19th century. At the beginning of the 20th century, the knitwear industry grew quickly, and would quickly take over as the town's main industrial speciality.³⁴

The industrial districts in the Region of Valencia also include one in the textile sector. Based on a longstanding craft tradition,³⁵ over the 19th century an area specialising in woollen textiles developed in what is today the north of Alicante province (the areas of L'Alcoià and El Comtat) and the south of Valencia province (in La Vall d'Albaida), with the main centre in Alcoy. This is a hilly area that up to the arrival of the 20th century was beset by serious transport difficulties. In Alcoy, at the beginning of the 19th century, the sec-

32. Llonch (1997, 2002, 2007).

33. Torras (1992).

34. Torras i Ribé (1974); Pascual (1990, 1991).

35. Torró (1994, 1996).

ondary sector already employed 70% of the active population, and textiles were by far the predominant sector, followed by paper production. Spinning jenny frames were introduced around 1820, and their replacement by spinning mules as of 1853 was so quick that by 1860 manual mules were already in the minority. It was also in the 1860s when all fulling mills were mechanised and the first mechanical looms were introduced, although their mechanisation would not be fully consolidated until the end of the 19th century. By the early 20th century, the Alcoy textile district had already become the second most important cloth centre in Spain, surpassed only by the Sabadell-Terrassa district. The process of technical modernisation occurred by means of a decentralised production structure, with a significant contribution from businesses specialising in various stages of the production process. Even though from the last quarter of the 19th century there had been a trend for large firms involved in the full production cycle to gather in the same location, in 1913 more than half of the technical equipment used in the dyeing process, 36% of weaving equipment and a sixth of the machinery used in the spinning industry remained in firms specialising in certain stages of the process.³⁶

In the north-west of Alicante province, near Alcoy, the valley region of Foia de Castalla began to specialise in toy manufacturing in the early 20th century. It was in the town of Onil where the first initiatives in the toy industry appeared. Around 1860, Ramón Mira Vidal began to craft dolls with clay heads, making use of the local clay and the town's pottery tradition. Ramón Mira's workshop grew until employing 50 workers at the end of the 19th century, when due to imitation other doll factories began to spring up in the town. However, it would be in Ibi, a town just over 11 kilometres away, where the toy industry would grow more quickly from the early 20th century onward, albeit with a different specialisation, in metal toys. Some Ibi merchants had worked since the 17th century storing snow to be sold in surrounding towns during the warmer months. This activity developed into the production and sale of ice-cream, and the growth of this business at the end of the 19th century led to small amounts of capital being invested in complementary activities, such as the manufacture of tin containers. With the arrival of the 20th century, these tinsmiths began to produce metal toys. The first were the members of the Payá family, who soon specialised in this type of production and by 1909 had a catalogue of almost 100 articles. Workers trained by this company would in later years go on to set up other toy factories. Greater competition led to technical modernisation among companies following the First World War. Higher-quality materials and product innovations followed, such as toys with springs and, from 1919, decoration with lithography. During the 1920s, as both the production and profit levels of toy companies grew, so did

36. Aracil & García Bonafé (1974); Vallès (1986); Cuevas (1999).

the population of Ibi, which had remained steady in the two previous decades, at an annual rate of just over 1.5%. The rise of the new industrial bourgeoisie was reflected in local politics, and in 1922 one of the members of the Payá family of toy makers became the town's mayor. In the 1930s, the toy district was strengthened with increased investments in the sector, more complete mechanisation, major increases in production, the development of new products (such as electric trains), the first exports (to North Africa and European countries), and the establishment of auxiliary industries. By then toys had become the town's main economic activity, with more workers than in agriculture, but the sector was dominated by two firms, *Paya Hermanos* and *Rico S.A.*, with more than 200 employees each. Industry in Onil continued to grow and innovations appeared (such as pressed cardboard) in the early decades of the 20th century, though at a slower pace. Growth came with the end of the Spanish Civil War, and in the 1950s the sector employed more than a third of the town's population, in an array of small and medium-sized firms.³⁷

From the districts studied, the toy district was formed later than all the others and had developed the least up to the 1930s. In contrast, the two Valencian footwear districts enjoyed rapid evolution from the end of the 19th century. Elche, in the lower Valle del Vinalopó in the south of Alicante province, near to the hemp-farming areas, was initially a town that specialised in the production of textile-based footwear. Manufacturing footwear of this kind went from being a traditional craft to an industrial production process in the second half of the 19th century. By the end of the century, the town had approximately 50 businesses, most of them small companies, which produced around six million pairs of espadrilles a year, which was probably a quarter of national production, and by the beginning of the 20th century the espadrille industry was already the local economy's main activity, with almost 4,000 workers, more than 38% of the entire active population. Growth in the sector continued at a good pace during the first half of the 20th century, reaching 40 million pairs a year and leading to a tightly formed auxiliary economic framework (specialising in canvas, jute braiding, packaging and metal items, machinery workshops, commercial, financial and transport services, etc.), and the industry began to spread to other nearby towns. The ensemble of external economies generated by the cluster of textile footwear firms also led from the early 20th century onward to the development of the leather footwear industry, with 65 companies in the town by the mid-1930s, producing nearly three million pairs a year. The industry's progress led to the town's population growing at an accelerated rate (between 1878 and 1940 it grew by 80%), due chiefly to the arrival of immigrants, and helped bring about social

37. Valero (1991, 1997); Atienza, Miralles & Viñas (1999); Ybarra & Santa María (2008); Quijada (2010).

mobility, as many of the town's new business owners were former workers. From the end of the 19th century, industrial entrepreneurs joined the elite members of local society in a prominent position, combining economic power, social prestige, political dominance and cultural patronage.³⁸

In the same Valle del Vinalopó, but in the middle area of this natural corridor that links inland Spain and the Mediterranean, the Elda district was formed, specialising in leather footwear. By the end of the 19th century several medium-sized footwear factories already existed in the town, alongside multiple workshops and many home-based workers, with an economic landscape emerging made up of, among other businesses, shoe-last and packaging factories, and merchants selling wholesale tanned leather and other articles relating to the footwear industry. From the early 20th century, the footwear industry began spreading to other nearby towns where labour was cheaper. The First World War gave a new and decisive boost to the footwear industry of Elda, with almost 4,000 workers who in 1915 produced 1.8 million pairs. In the 1920s, the benefits accrued during wartime and increased demand on the Spanish market led to growth and technical innovation within the sector. It also produced a change to the predominant kind of enterprise. Although small workshops and working from home still existed, medium-sized firms with around 100 workers were responsible for most of what was produced. In 1935, the local industry had more than 6,000 workers and production exceeded five million pairs of shoes a year. According to the Municipal Register of Inhabitants of 1940, almost 73% of the population worked in the industry, and of these 85% were workers making footwear, with the rest employed in the various auxiliary industries. Since the end of the First World War, footwear business owners became firmly established as the dominant class in the town. They were in charge of the local political parties, the main associations and the local council.³⁹

The origins of the ceramic tile district of La Plana de Castellón, of which Onda was the centre during the period analysed in this study, seems to be closely linked to the existence of raw materials (high-quality clay) and hydraulic power in the area, and with the establishment in 1727 of a Royal Factory of Fine Pottery and Porcelain in Alcora, a town close to Onda, on the initiative of the Count of Aranda. This royal factory acted as a training, technical and artistic college for the local labour force. From here, from the end of the 18th and throughout the 19th century, came many of the entrepreneurs of pottery factories that opened in Alcora, Onda and other neighbouring towns. The region began to accumulate specific knowledge, and consequently attained a level of quality in the production process that would be decisive in

38. Miranda (2004, 2006).

39. Bernabé (1976); Valero, Navarro, Martínez & Amat (1992); Miranda (2009).

the area's success over other centres of production. Until the mid-19th century, most ceramic production was in tableware and figures, but from this point and particularly in the last decades of the century, the increased demand for tiles led to major growth in this type of production. By the start of the 20th century, La Plana of Castellón was already the main area for tile production in Spain, and within the area Onda enjoyed the greatest development, with 19 tile businesses in 1910, and 38 in 1925. In this last year, to ensure the availability of a specialist workforce, a technical school was opened in the town, with backing from the provincial council. By the end of the 1920s, the town produced more than half of all the tiles made in Spain. As of the First World War, industry in Onda also dominated exports of tiles, and in the 1930s was responsible for 60% of all Spanish tile exports. This diversification of the markets was accompanied by major technical innovation in the 1920s and 1930s, as electricity entered into general use and passage ovens began to be used.⁴⁰

Finally, the chosen sample of industrial districts at the beginning of the 20th century also includes the firearms district of Eibar, a town in the province of Guipúzcoa, located in the Deva river basin and bordering the province of Vizcaya. The town's tradition of working with iron and armoury production, dating back to at least the modern era, led to the emergence in the late 19th century of an industrial district specialising in weaponry, particularly medium and low quality side arms. This production of weapons, which in 1881 already exceeded 130,000 units, tripled during the last decades of the 19th and the first decade of the 20th century, reaching 500,000 units in 1909. Growth was helped by companies installing electricity in the 1890s. This growth was reflected in the town's population, which doubled between 1887 and 1910, when it surpassed 10,000 inhabitants, of whom 20% worked in the firearms industry.⁴¹ Production was decentralised in its structure, where some companies "with patents and trademarks subcontracted the manufacture of pieces and the production of certain operations to workshops in the town, to then carry out the final assembly in their own facilities".⁴² There was a predominance of small companies with fewer than 50 workers. The weapons manufacturers held control of the local council, and as the 20th century advanced there was also a notable presence of representatives of workers from the sector among the councillors, so that the council was involved in various initiatives from the early 20th century onward to strengthen the firearms industry, such as the creation in 1913 of an Armoury College to train technicians in the industry, and an Official Test Facility in 1921. Sales from the Eibar weapons industry were spectacular during the First World War. Following the end of

40. Membrado (2001); Miranda (2011).

41. Catalan (1990); Calvó (1997); Goñi (2007, 2009).

42. Goñi (2010).

the war, the sector suffered a sharp fall in demand, which led the district to try other metallurgical production processes, such as sewing machines, bicycles, writing implements, tooling machines and electric appliances. This evolution was strengthened in the 1940s by the new state regulation of the weapons industry, which required side arm production to be carried out by full-cycle businesses and in industrial facilities with an enclosed perimeter.

Technological innovation in industrial districts at the beginning of the 20th century

To analyse the capacity for technological innovation of the ten industrial districts selected, a database was created with all the patents that were filed in Spain between 1878 and 1935 by people residing in the towns around which these districts were based. Each district has been identified as the main town in the area. More than one town has been taken into account in the wool district of the Maresme (Mataró and Calella) and the toy district of la Foia de Castalla (Ibi and Onil). In both cases, these were towns that were at the origin of the district from the start, but where the predominant industrial activity grew until each town became a separate local system of production.⁴³ In total, 2,710 applications were filed, but they were divided very unequally among the districts. Eibar accounts for almost one third of all patents, with the textile districts of Alcoy and Sabadell making up around 20% each. A further 20% comes from the textile districts of Mataró-Calella and Manresa. However, in the other five districts, the number of patents is very low in comparison, and does not reach 10% of the total.

To be able to make a suitable comparison between the various districts, as well as with other geographic areas and other periods, the innovation indicator was normalised by taking into account the population and the number of years in the period. The innovation indicator was therefore calculated as the mean annual number of patents filed per 100,000 inhabitants. The result goes even further to highlight the technological capacity of Eibar, which has eight times more patents than the mean figure for all districts, whereas Sabadell, Alcoy and Mataró-Calella are at or around the mean value, and the rest of the districts have very low figures, particularly Onda, Igualada and Elche. The differences in technological capacity of the various districts becomes clear when observing that the arithmetic mean of the ratio is 28.1, and the standard deviation is 65.8. If these figures are compared with those for all patents filed by residents in Spain, it can be observed that the mean figure for the ten districts is considerably higher than the mean for Spain as a whole (385%),

43. Boix & Galletto (2006).

and that only the Onda district scores lower. If the comparison is made with the mean figures obtained for ten medium-sized cities with a certain level of industrial activity, again, the districts are shown to have a high capacity for innovation, with a ratio that is almost double that of the group of cities (Table 1).

It could be concluded, therefore, that even in the initial stages as industrial districts evolved, in general they were more fertile grounds for innovation than other types of territories. This would confirm the theoretical position

TABLE 1 • *Capacity for innovation of industrial districts, 1878-1935*

Districts	Patents	Population in 1900	Mean annual number of patents per 100,000 inhabitants	Difference with regard to Spanish mean	% difference with regard to Spanish mean	Difference with regard to regional mean	% difference with regard to regional mean
Eibar	847	6,583	221.8	216.0	3,724.8	212.9	2,392.5
Alcoy	512	32,053	27.5	21.7	374.8	22.6	462.1
Sabadell	542	23,294	40.1	34.3	591.7	15.5	63.1
Manresa	231	23,252	17.1	11.3	195.3	-7.5	-30.4
Igualada	37	10,442	6.1	0.3	5.3	-18.5	-75.2
Mataró-Calella	327	24,020	23.5	17.7	304.7	-1.1	-4.6
Elche	102	27,308	6.4	0.6	11.0	1.5	31.4
Elda	48	6,131	13.5	7.7	132.7	8.6	175.5
Ibi-Onil	54	6,571	14.2	8.4	144.3	9.3	189.2
Onda	10	6,595	2.6	-3.2	-54.9	-2.3	-46.6
10 districts	2,710	166,249	28.1	22.3	384.6		
Spain	62,710*	18,594,405	5.8	0.0	0.0		
Region of Valencia	4,469*	1,587,500	4.9	-0.9	-15.5		
Catalonia	28,075*	1,966,400	24.6	18.8	324.1		
Basque Country	5,138*	603,600	14.7	8.9	153.4		
10 cities **	8,731	971,467	15.8	10.0	172.4		

* The figures for the 1925-1929 period have been interpolated.

** Valencia, Seville, Malaga, Zaragoza, Bilbao, Granada, Valladolid, Santander, Alicante and Gijon.

Sources: Sáiz (2005), Spanish population census conducted in 1900 and database of patents of the Spanish Office for Patents and Trademarks.

which states that the capacity to generate and adopt innovations is an essential characteristic of industrial districts, regardless of the economic context in which they develop. Table 2 shows three periods (1878-1900, 1901-1915 and 1916-1935) that indicate how the advantage in capacity for innovation held by the districts evolved with regard to the mean for the country as a whole. The figures show that this difference dropped sharply in the first 15 years of the 20th century compared with what occurred at the end of the 19th century, but increased again between 1916 and 1935, albeit at lower levels than in the 19th century. The drop in difference at the beginning of the 20th century was due to the fact that the ratio improved to an extraordinary degree for Spain as a whole, and only to a moderate extent for industrial districts. In contrast, in the last two decades of the period studied, the ratio dropped for

TABLE 2 - Mean annual number of patents per 100,000 inhabitants and difference with regard to the Spanish mean (1878-1900, 1901-1915 and 1916-1935)

Districts	Patents 1878- 1900	% difference	Patents 1901-1915	% difference	Patents 1916- 1935	% difference
Eibar	95.4	3,434.3	175.9	1,429.3	190.3	2,404.0
Alcoy	20.5	658.2	36.0	213.0	24.7	224.4
Sabadell	79.2	2,832.8	27.5	139.1	37.2	389.0
Manresa	29.5	991.0	13.9	21.0	23.2	204.9
Igualada	21.1	681.7	5.0	-56.1	6.8	-10.0
Mataró- Calella	26.2	869.0	21.9	90.4	28.1	270.0
Elche	2.6	-5.5	3.3	-71.5	10.4	36.7
Elda	0.0	-100.0	7.5	-35.0	14.5	90.8
Ibi-Onil	3.5	28.0	7.2	-37.3	29.8	291.8
Onda	0.0	-100.0	1.9	-83.5	5.4	-29.6
10 districts	20.6	663.8	27.0	134.4	31.8	318.1
Spain	2.7	0.0	11.5	0.0	7.6	0.1
Region of Valencia	2.3	-14.9	5.1	-55.8	8.4	11.0
Catalonia	10.5	287.6	21.4	86.2	40.5	432.4
Basque Country	7.2	165.3	13.5	17.1	22.0	188.8

Sources: Sáiz (2005), Spanish population census conducted in 1887, 1900, 1910 and 1930, and database of patents of the Spanish Office for Patents and Trademarks.

the country as a whole, whereas it continued to grow for the districts, particularly in those specialising in footwear, toys and ceramic tiles.

The strong disparities between districts also suggest that the capacity for innovation did not depend solely on the favourable environment created by the Marshallian economies of localisation, but rather was also heavily influenced by other factors. Firstly, it would seem that sector-based specialisation was decisive, as there were huge differences in the propensity to patent the various branches of industry. According to the study by Ortiz-Villajos on patents registered in Spain between 1882 and 1935,⁴⁴ the mechanical industry produced most patents in Spain (a quarter of all those accounted for in the study), of which most were for the production of weapons. This largely explained the particularly high ratio of patents per head of population in Eibar. It would also appear to be true that sector-based specialisation is responsible for most textile districts showing high levels of innovation, as the textile industry was second only to the mechanical sector in the number patents in Spain during the period studied (19% of those accounted for by Ortiz-Villajos). The contrast would come from the ceramics industry, which barely generated any patents before the Spanish Civil War, despite the fact that the industry underwent major technical innovation as of the 1920s,⁴⁵ so that the low ratios for the Onda district would be influenced, at least in part, by the characteristics of its main industry, which based its innovation on imported technology.

The innovative behaviour of the districts would also appear to be highly influenced by proximity to territories where technical knowledge tended to concentrate. On the one hand, the degree of development of regional innovation systems (the set of agents and relationships that interact in the production, diffusion and use of new and economically useful knowledge)⁴⁶ would have a significant influence. Thus, all the Catalanian districts benefited from their location in the region with the greatest technological capacity in the country, which contributed around 45% of all patents applied for by Spanish residents. As Table 1 shows, whereas all Catalanian districts had patent ratios that are above the mean figure for Spain as a whole, only Sabadell is above the regional average. On the other hand, Barcelona was the main regional centre of accumulation of technical knowledge, not only for its dense and varied network of industries and services, but also because it had key technical training institutions, such as the *Escuela Industrial Barcelonesa* (Industrial School

44. Ortiz-Villajos (1999).

45. Gomis (1990); Membrado (2001).

46. On innovation systems, see Lundvall (1992); on regional innovation systems, Asheim & Isaksen (2002). The positive influence of the most developed regional innovation systems is based on the fact that “this set of actors produce pervasive and systemic effects that encourage firms within the region to develop specific forms of capital that is derived from social relations, norms, values and interaction within the community in order to reinforce regional innovative capability and competitiveness” (Doloreux & Parto, 2004, p. 9, and Gertler, 2003).

of Barcelona), where more than 2,300 industrial engineers graduated between 1861 and 1936.⁴⁷ Hence, the Catalan districts with the highest ratios are Sabadell and the Maresme district, which are nearest to the city of Barcelona. Consequently, the innovative capacity of industrial districts not only has relied on Marshallian local externalities, but also on the influence of Jacobs' externalities, since the proximity of a diversified economy, with a high standard of technology and a wide range of related industries, would have facilitated the production of new ideas and innovations. According to Frenken, Van Oort and Verburg,⁴⁸ the higher the number of related industries in a region, the more opportunities exist for effective knowledge transfer between sectors. Therefore, the existence in Catalonia of several clusters of related industries and a major industrial and services centre would have increased learning opportunities for local industries, boosting the innovative capacity of industrial districts. Because the closer actors are in a better position to benefit from the dissemination of knowledge,⁴⁹ at least in the case of knowledge of moderate complexity,⁵⁰ the positive influence of Barcelona on innovation within regional districts has been inversely proportional to the distance. The regional environment probably had a positive effect on the Eibar district as well, albeit to a lesser extent. In contrast, the low mean level of innovation in the Region of Valencia was a contributing factor in the low ratios for patents from these districts. As a result, the Valencian town with the highest ratio, Alcoy, has much lower scores than those for Sabadell, which specialised in the same woollen textile industry. Low ratio levels for patents are also reported for Elche and Elda, the footwear districts in the Region of Valencia, at least until 1915 (Table 2), despite the fact that footwear is one of the consumer goods industries that generated most patents in Spain – almost 2% of those accounted for in the study by Ortiz-Villajos. In 1935, when Elche and Elda were already the biggest centres of the footwear industry in Spain, these cities only generated 7.8% of the patents linked to this industry applied for by residents in the country. Similarly, the town of Onda, despite becoming the main centre for the Spanish tiling industry by the beginning of the 20th century, only generated 7.5% of the patents relating to tiles between 1901 and 1935.

A third element that affected the capacity to generate technology in the districts was the human capital involved. Broad differences can be observed in the level of training of the various populations, even with such basic indicators as the percentage of the population that was literate (Table 3). Although this relationship does not apply to all cases, the towns with the high-

47. Nadal, Benaül & Sudrià (2012), pp. 65-66.

48. Frenken, Van Oort & Verburg (2007).

49. Boschma & Frenken (2011).

50. Sorenson, Rivkin & Fleming (2006).

TABLE 3 • *Percentage of literate population in districts, 1930*

Towns	% literate		
	Male	Female	Total
Eibar	80.1	76.6	78.4
Mataró	77.9	67.6	72.5
Calella	74.2	66.8	70.1
Sabadell	75.4	63.4	69.0
Manresa	78.2	60.7	68.9
Igualada	74.6	62.8	68.4
Ibi	67.1	50.3	58.4
Alcoy	68.6	48.8	58.0
Onil	51.2	48.2	49.6
Elda	57.8	41.5	49.4
Elche	51.9	31.9	41.7
Onda	47.8	25.1	36.4

Source: Spanish population census.

TABLE 4 • *Results of the regression analysis between literacy and innovation in industrial districts*

Dependent Variable: PATENTS. Method: Least Squares. Sample: 1 11 Included observations: 11				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-19661.10	12902.65	-1.523803	0.1619
LITERACY	416.1957	207.2172	2.008499	0.0755
R-squared	0.309502	Mean dependent var.		5689.000
Adjusted R-squared	0.232780	S.D. dependent var.		10144.86
S.E. of regression	8885.994	Akaike info criterion		21.18531
Sum squared resid.	7.11E+08	Schwarz criterion		21.25765
Log likelihood	-114.5192	F-statistic		4.034069
Durbin-Watson stat.	1.698245	Prob. (F-statistic)		0.075511

est levels of literacy tend to be the most innovative. To check this, a simple regression analysis was conducted using the ordinary least squares method between the percentage of literate inhabitants in each district and the level of innovation (measured by means of the difference in the ratio of patents compared with the national average). The result reported in Table 4 is significant

at the 10% error level and the level of literacy is able to explain about 31% of the variations in the ratio of patents.

It is highly revealing that some districts, particularly in the Region of Valencia, show such low levels of education. It indicates that, despite how dynamic the districts may have been and despite their capacity for innovation, industry in these territories competed mainly on price, by using cheap labour. For most of the districts, the technological changes that had most effect came from elsewhere, usually in the form of imported machinery or by imitating new products. For this reason, their capacity for innovation was reflected chiefly in how they assimilated foreign technology. In Elda, for example, just as the number of patents filed increased as the town developed, particularly in the 1920s and onward, technological innovation from other countries was also taking less time to reach the district. At that time, the United Shoe Machinery Company, an American firm, held what was almost a monopoly in machinery for the footwear industry, and controlled the most advanced specific technology for the sector. New machinery brought into Spain by this company in 1912 took a mean time of 1,370 days to reach the Elda industrial district, but in 1925 this time had dropped to 652 days, in 1930 it took 243 days, and in 1935 it took no longer than 98 days.⁵¹ Small incremental innovations developed in the industrial districts that helped companies to become more competitive, but did not secure any decisive technological advantage. This was true even in Eibar, by far the leading district in terms of capacity for innovation from among the sample studied. The weapons manufacturers in Eibar opted not to develop proprietary technology that would allow them to compete on quality and product differentiation; rather, their strategy consisted of imitating foreign models but using worse materials and simpler internal mechanisms to lower costs and therefore compete on price. This strategy was based on patent legislation, which established that any patent filed in Spain and not implemented within three years lost all effect, meaning that many inventions lost their protection and could be imitated.⁵²

In the early stages of the various districts' development, a factor that was at least as important as the capacity for innovation was their access to the low-cost workforce of the local population, due to informal mechanisms (the "industrial atmosphere") used to train workers, and flexibility in the structures of production that allowed women and children to be widely used, work to be done at home and part-time hours kept. Thus, in the origins of the Ibi toy industry, there were many farm labourers who were willing to work in the factories for low wages, and even owners of smallholdings, who combined their work in the fields with industrial employment, given that, due to the season-

51. USM Spain archive: data sheets for machinery.

52. Goñi (2007).

al nature of the demand for toys, most of this work was in the last quarter of the year. This industry also employed many women, whose wages were half those of men, and children, who often started working from the age of ten. In this initial stage of development of the district, businesses lacked highly skilled staff and produced simple articles at low prices that were imitations of foreign models.⁵³ A very similar situation existed in the footwear industry districts of Elche and Elda, where working at home was very common, together with female and child labour, and which during this period produced mainly low quality footwear. In Elche around the year 1910, 70% of the workers in the footwear industry were women, with wages that were 60% lower than men's wages, and three quarters of these women worked at home. In the leather footwear industry, more than half of the operators were children, who earned between six and ten times less than adults, whose wages in turn were 20% to 40% lower than those of footwear industry workers in Barcelona.⁵⁴ Low labour costs were equally important in the textile districts. As stated by Llusà, one of the reasons that industrial development in Manresa was possible was "an abundant workforce that was cheaper than in Barcelona".⁵⁵ According to the figures published by Madoz in his *Dictionary*, in 1841 wages in the textile industry were significantly lower in the other towns of Catalonia that developed industrial districts than in the city of Barcelona.⁵⁶ In Sabadell, wages remained low throughout the first quarter of the 20th century; for a family with three children, including two under 14 years of age, at least two of the children had to be in work in order to meet the family's needs.⁵⁷ Even the district with the highest export capacity in the first third of the 20th century, the Maresme district, which specialised in woollen garments, based its competitiveness on low labour costs.⁵⁸

Conclusions

In the Spain of the early 20th century, sector-specific clusters of industry, consisting mainly of small and medium-sized firms, already existed in the

53. Valero (1997).

54. Miranda (2006).

55. Llusà (2002), p. 73.

56. Ferrer (2004). In Manresa, women's wages, which were the most numerous, were lower than in Barcelona by 59% in spinning and 42% in weaving, whereas men's wages were 29% lower in weaving, and children's wages were 31% lower in weaving and 22% lower in spinning. In Igualada, men's wages were 46% lower than in Barcelona in the spinning sector and 24% in weaving, whereas women's wages, which also predominated, were 55% lower in spinning and 22% in weaving. In Mataró, women's wages were 13% lower in the weaving sector.

57. Deu (1987).

58. Llonch (2005).

towns of Eibar, Sabadell, Mataró-Calella, Manresa, Igualada, Alcoy, Elche, Elda, Ibi-Onil and Onda. Others undoubtedly also developed, but these ten have two important advantages: firstly, that the literature available on their industrial history means that they can be safely characterised as Marshallian industrial districts during this period; and secondly, that these ten industrial districts have survived to the present day, with a notable position within their particular main industry, qualifying them as cases with a solid district-based structure and competitive capacity. Analysis of these cases therefore allows for an initial significant examination of the capacity for innovation of industrial districts in the first stages of their development, which may help to shed light on whether the current intensity of technological change in production systems of this type is an essential and inherent characteristic, or if in contrast it is the result of having to adapt to the current economic context.

Analysis of the patents filed by the ten cases in the period between 1878 and 1935 suggests that their capacity for innovation, related to the size of their populations, was higher than the average for Spain as a whole, and higher even than the figures for industrialised cities with important urbanization economies, such as Valencia, Seville and Zaragoza. The result of this modest exercise examining the past coincides, therefore, with the result obtained by Boix and Galletto for the beginning of the 21st century, and would appear to confirm that, by their nature, industrial districts are an innovative medium thanks to the external economies of localization, both static and dynamic, that they generate, the mechanisms of cooperation that they provide, and the intense competition that the businesses within them experience.

However, analysis of the patents from that period also shows large differences between districts in the degree of innovation. This suggests that, as well as the “district effect”, there were other factors that had as much if not more influence on their capacity for technological innovation. By examining the characteristics of such districts, three main determining factors can be identified. The first is sector-specific specialisation. Not all industries had the same technological dynamics, and more particularly not all the industries reflected the extent of their innovations in the patents that were filed. Secondly, the capacity for innovation in the districts depended to a large extent on the degree of accumulation of technological knowledge in their environment. The clearest case is that of the districts in Catalonia, which benefited from being in an area, specifically the highly industrialised province of Barcelona, where a large amount of technical information was in circulation. Finally, innovation was also closely linked to the human capital that existed in the districts.

The fact the industrial districts were favourable places for innovations to be generated in the early 20th century does not mean that their competitive advantage was therefore based on technological superiority. All the cases analysed based their competitiveness on price and on reducing production costs

by user cheaper labour. Throughout this period, technological innovation occurred in these industrial districts mainly by adapting foreign technology and through small, gradual and complementary changes that helped to improve efficiency in the system, but without altering its fundamental characteristics.

BIBLIOGRAPHY

- ARACIL, R. & GARCÍA BONAFÉ, M. (1974), *Industrialització al País Valencià. El cas d'Alcoi*, Valencia, Tres i Quatre.
- ASHEIM, B. T. & ISAKSEN, A. (2002), "Regional Innovation Systems: The Integration of Local 'Sticky' and Global 'Ubiquitous' Knowledge", *The Journal of Technology Transfer*, 27, 1, pp. 77-86.
- ATIENZA, M.; MIRALLES, M. A. & VIÑAS, A. I. (1999), *Transformación y ajuste productivo en los sistemas locales de empresas: el Valle del juguete*, Valencia, Fundación Universitaria San Pablo CEU.
- AUDRETSCH, D. B. & FELDMAN, M. P. (1996), "R&D spillovers and the geography of innovation and production", *American Economic Review*, 86, 3, pp. 630-640.
- BAGELLA, M. & BECCHETTI, L. (eds.) (2000), *The competitive advantage of industrial districts. Theoretical and empirical analysis*, Heidelberg, Physica-Verlag.
- BALFOUR, S. et al. (1994), *Indústria i ciutat: Sabadell, 1800-1980*, Barcelona, Publicacions de l'Abadia de Montserrat.
- BECATTINI, G. (1989), "Riflessioni sul distretto industriale marshalliano come concetto socio-economico", *Stato e Mercato*, xxv, pp. 111-128.
- BECATTINI, G. (2004), "The industrial district as a creative *milieu*", in *Industrial districts. A new approach to industrial change*, Cheltenham, Edward Elgar, pp. 34-47.
- BELUSSI, F. & GOTTARDI, G. (eds.) (2000), *Evolutionary patterns of local industrial systems. Towards a cognitive approach to the industrial district*, Aldershot, Ashgate.
- BELLANDI, M. (1996), "Innovation and change in the Marshallian industrial districts", *European Planning Studies*, 4, pp. 357-368.
- BELLANDI, M. (2007), "Industrial districts and waves of industrialization: A rich and contested terrain", *Scienze Regionali. Italian Journal of Regional Science*, 6, pp. 7-33.
- BENAU, J. M. (1992), "Los orígenes de la empresa textil lanera en Sabadell y Terrassa en el siglo XVIII", *Revista de Historia Industrial*, I, pp. 39-62.
- BENAU, J. M. (1994), "La industrialització de Sabadell: per què i com", in BALFOUR, S. et al., pp. 27-66.
- BENAU, J. M. (1995), "Cambio tecnológico y estructura industrial. Los inicios del sistema de fábrica en la industria pañera catalana, 1815-1835", *Revista de Historia Económica*, XIV, 2, pp. 199-226.
- BERNABÉ, J. M. (1976), *La Industria del Calzado en el Valle del Vinalopó*, Valencia, Departamento de Geografía de la Universidad de Valencia.

- BOIX, R. & GALLETTO, V. (2006), *El nuevo mapa de los distritos industriales de España y su comparación con Italia y el Reino Unido*, Document de Treball 06.04, Department of Applied Economics, Barcelona, UAB.
- BOIX, R. & GALLETTO, V. (2008), “Marshallian industrial districts in Spain”, *Scienze Regionali – Italian Journal of Regional Science*, 7, 3, pp. 29-52.
- BOIX, R. & GALLETTO, V. (2009), “Innovation and industrial districts: a first approach to the measurement and determinants of the I-district effect”, *Regional Studies*, 43, 9, pp. 1117-1133.
- BOSCHMA, R. & FRENKEN, K. (2011), “The emerging empirics of evolutionary economic geography”, *Journal of Economic Geography*, 11, 2, pp. 295-307.
- CAINELLI, G.; MANCINELLI, S. & MAZZANTI, M. (2005), *Social capital, R&D and industrial districts*, FEEM working paper series, Milan, FEEM.
- CAINELLI, G. & DE LISO, N. (2006), “Innovation in Industrial Districts: Evidence from Italy”, *Industry & Innovation*, 12, 3, pp. 383-398.
- CALVET, J. (1994), “Indústria i finances: de la Guerra civil a la dècada dels seixanta”, in S. BALFOUR et al., pp. 95-124.
- CALVÓ, J. L. (1997), *La industria armera nacional 1830-1940. Fábricas, Privilegios, Patentes y Marcas*, Eibar, Comisión Ego Ibarra.
- CAMAGNI, R. (2003), “Incertidumbre, Capital Social y Desarrollo Local: enseñanzas para una gobernabilidad sostenible del territorio”, *Investigaciones Regionales*, 2, pp. 31-57.
- CAMPS, E. (1997), “Las transformaciones del mercado de trabajo en Cataluña (1850-1925): migraciones, ciclos de vida y economías familiares”, *Revista de Historia Industrial*, 11, pp. 45-71.
- CASANUEVA, C.; CASTRO, I. & GALÁN, J. L. (2010), “Capital social e innovación en clusters industriales”, *Revista Europea de Dirección y Economía de la Empresa*, 19, 4, pp. 37-58.
- CATALAN, J. (1990), “Capitales modestos y dinamismo industrial: orígenes del sistema de fábrica en los valles guipuzcoanos, 1841-1918”, in J. NADAL & A. CARRERAS (eds.), pp. 125-158.
- CATALAN, J.; MIRANDA, J. A. and RAMON-MUÑOZ, R. (2011), “Distritos, clusters y ventaja competitiva: interpretaciones y debates”, in J. CATALAN, J. A. MIRANDA & R. RAMON-MUÑOZ (eds.), pp. 9-36.
- CATALAN, J.; MIRANDA, J. A. and RAMON-MUÑOZ, R. (eds.) (2011), *Distritos y clusters en la Europa del sur*, Madrid, LID.
- CLARK, G. L.; FELDMAN, M. P. & GERTLER, M. S. (eds.) (2000), *The Oxford Handbook of Economic Geography*, Oxford, Oxford University Press.
- COSTA, M. T.; DUCH, N. & LLADÓS, J. (2000), “Determinantes de la innovación y efectos sobre la competitividad: el caso de las empresas textiles”, *III Encuentro de Economía Aplicada*, Valencia, Universidad de Valencia.
- CUEVAS, J. (1999), “Innovación técnica y estructura empresarial en la industria textil de Alcoi, 1820-1913”, *Revista de Historia Industrial*, 16, pp. 13-44.

- DESROCHERS, P. (1998), "On the abuse of patents as economic indicators", *The Quarterly Journal of Austrian Economics*, 1, 4, pp. 51-74.
- DEU, E. (1987), "Evolució de les condicions materials dels obrers sabadellencs de la indústria llanera en el primer quart del segle XX", *Arraona*, I, pp. 43-52.
- DEU, E. (1990), *La industria textil llanera de Sabadell, 1896-1925*, Sabadell, Col·legi Oficial de Doctors i Llicenciats en Filosofia i Lletres i en Ciències de Catalunya.
- DEU, E. (1994), "Consolidació i lideratge de la indústria textil llanera", in BALFOUR, S. et al., pp. 67-94.
- DOLOREUX, D. & PARTO, S. (2004), *Regional Innovation Systems: A Critical Synthesis*, United Nations University. INTECH, Discussion Paper Series 2004-17.
- ENRIGHT, M. (1995), "Organisation and co-ordination in geographically concentrated industries", in RAFF, D. & LAMOREUX, N. (eds.), pp. 103-146.
- EXPÓSITO, M.; MOLINA, F. X. & CAPÓ, J. (2010), "Influencia de las dimensiones de la capacidad de absorción en el desarrollo de nuevos productos en un contexto de distrito industrial. Un estudio empírico al caso del textil valenciano", *Investigaciones Regionales*, 17, pp. 29-50.
- FERRER, LL. (1986), *Els orígens de la industrialització a la Catalunya central*, Barcelona, Rafael Dalmau.
- FERRER, LL. (2004), "Bergadanas, continuas y mules. Tres geografías de la hilatura del algodón en Cataluña (1790-1830)", *Revista de Historia Económica*, XXII, 2, pp. 337-386.
- FRENKEN, K.; VAN OORT, F. G. & VERBURG, T. (2007), "Related variety, unrelated variety and regional economic growth", *Regional Studies*, 41, 5, pp. 685-697.
- GABALDÓN, D.; FERNÁNDEZ, I. & TORTAJADA, E. (2005), "Industrial districts structure and chances for innovation: an empirical experience", in *5th Triple Helix Conference*, Torino, 18-21 May 2005.
- GALLETTO, V. (2008), "Distritos industriales e innovación", *Mediterráneo Económico*, 13, pp. 117-137.
- GARCIA BALANÁ, A. (2003-4), "Animes i telers. Canvis materials, malestars socials i combats culturals al Sabadell de l'últim terc del segle XIX (1868-1890)", *Recerques*, 47-48, pp. 107-130.
- GOMIS, J. M. (1990), *Evolució històrica del taulellet*, Castellón, Diputació de Castellón.
- GOÑI, I. (2007), "Evolución de la industria armera vasca (1876-1969): un enfoque a largo plazo", in PASCUAL, P. & FERNÁNDEZ PÉREZ, P. (eds.), pp. 385-432.
- GOÑI, I. (2009), "La internacionalización de la industria armera vasca, 1876-1970. El distrito industrial de Eibar y sus empresas", *ICE*, 849, pp. 79-95.
- GOÑI, I. (2010), "Eibar y la industria armera: evidencias de un distrito industrial", *Investigaciones de Historia Económica*, 6, 16, pp. 101-133.
- GORDON, I. R. & McCANN, P. (2005), "Clusters, innovation and regional development: an analysis of current theories and evidence", in KARLSSON, C.; JOHANSSON, B. & STOUGH, R. R. (eds.), pp. 29-57.
- GRAZIANI, A. (ed.) (1975), *Crisi e ristrutturazione nell'economia italiana*, Torino, Einaudi.

- GRILICHES, Z. (1990), "Patent statistics as economic indicators: a survey", *Journal of Economic Literature*, XXVIII, pp. 1.661-1.707.
- HARRISON, B. (1994), *Lean and Mean: The Changing Landscape of Corporate Power in the Age of Flexibility*, New York, Basic Books.
- JONES, G. & ZEITLIN, J. (eds.) (2007), *The Oxford Handbook of Business History*, Oxford, Oxford University Press.
- KARLSSON, C.; JOHANSSON, B. & STOUGH, R. R. (eds.) (2005), *Industrial clusters and inter-firm networks*, Cheltenham, Edward Elgar.
- LAMOREAUX, N. R.; RAFF, D. M. G. & TEMIN, P. (eds.) (1999), *Learning by doing in markets, firms, and countries*, Chicago, University of Chicago Press.
- LAMOREAUX, N. R. & SOKOLOFF, K. (1999), "Inventors, Firms, and the Market for Technology in the Late Nineteenth and Early Twentieth Centuries", in LAMOREAUX, N. R.; RAFF, D. M. G. & TEMIN, P. (eds.), pp. 19-60.
- LAZZERETTI, L. & CAPONE, F. (2009), *Industrial district effects and innovation in the Tuscan shipbuilding industry*, IERMB Working Paper in Economics, 09.03, Barcelona, Institut d'Estudis Regionals i Metropolitans de Barcelona.
- LÓPEZ, M.; MAS, F. & MOLINA, F. X. (2008), "Política tecnològica aplicada a los distritos industriales", *Mediterráneo Económico*, 13, pp. 435-458.
- LÓPEZ ESTORNELL, M. (2010), *Empresa innovadora, conocimiento y distrito industrial*, Tesis doctoral, Valencia, Universidad Politécnica de Valencia.
- LUNDVALL, B. (ed.) (1992), *National Systems of Innovation; Towards a Theory of Innovation and Interactive Learning*, London, Pinter.
- LLONCH, M. (2002), *El gènere de punt a Catalunya i Mataró. Modernització i desenvolupament d'un sector industrial*, Mataró, Patronat Municipal de Cultura.
- LLONCH, M. (2002), "Tecnologia i modernització a la indústria del gènere de punt a Catalunya: una perspectiva històrica", in VIRÓS, LL. (ed.), pp. 93-110.
- LLONCH, M. (2007), *Tejiendo en red: la industria del género de punto en Cataluña (1891-1936)*, Barcelona, Universitat de Barcelona.
- LLUSSA, R. (2002), "El desenvolupament local en l'espai en xarxa. Xarxes socials i milieu a l'àrea urbana de Manresa", *Documents d'Anàlisi Geogràfica*, 41, pp. 63-82.
- MACLEOD, C. (1988), *Inventing the industrial revolution*, Cambridge, Cambridge University Press.
- MARTIN, R. (2006), "The localization of industry", in RAFFAELLI, T.; BECATTINI, G. & DARDI, M. (eds.), pp. 393-400.
- MEMBRADO, J. C. (2001), *La indústria ceràmica de La Plana de Castelló*, Diputació de Castellón, Castellón.
- MIRANDA, J. A. (2004), "Industrialización y distritos industriales: la Comunidad Valenciana", in DI VITTORIO, A.; BARCIELA, C. & FONTANA, G. L. (eds.), pp. 219-248.
- MIRANDA, J. A. (2006), *La formación de una ciudad industrial. Elx, 1850-1970*, Elche, Ayuntamiento de Elche.

- MIRANDA, J. A. (2009), "Competing in Fashion Goods: Firms and Industrial Districts in the Development of the Spanish Shoe Industry", *Business and Economic History Online*, vol. 7.
- MIRANDA, J. A. (2011), "La competitividad internacional de los distritos industriales valencianos: un análisis desde la historia económica", in CATALAN, J.; MIRANDA, J. A. & RAMON-MUÑOZ, R. (eds.), pp. 185-212.
- MOLINA-MORALES, F. X. (2002), "Industrial districts and innovation: the case of the Spanish ceramic tiles industry", *Entrepreneurship & Regional Development*, 14, 4, pp. 317-335.
- MOLINA, F. X.; ARES, M. A. & MOLINA, C. (2010), "Capital social e innovación en los distritos industriales. Una aplicación a los casos de la cerámica y del mueble", *Revista de treball, economia i societat*, 55, pp. 21-33.
- MUSET, A. (2002), "Canvi tècnic i transformació del sector seder català al segle XVIII. La cinteria manresana", in VIRÓS, LL. (ed.), pp. 73-82.
- NADAL, J.; BENAUL, J. M. & SUDRIÀ, C. (dirs.) (2012), *Atles de la industrialització de Catalunya 1750-2010*, Barcelona, Edicions Vicens Vives.
- NADAL, J. & CARRERAS, A. (eds.) (1990), *Pautas regionales de la industrialización española (Siglos XIX y XX)*, Barcelona, Ariel.
- OLIVERAS, J. (1985), *Desenvolupament industrial i evolució urbana a Manresa (1800-1870)*, Manresa, Caixa d'Estalvis de Manresa.
- OLIVERAS, J. (1986), *La consolidació de la ciutat industrial: Manresa (1871-1900)*, Manresa, Caixa d'Estalvis de Manresa.
- ORTIZ VILLAJOS, J. M. (1999), *Tecnología y desarrollo económico en la historia contemporánea. Estudio de las patentes registradas en España entre 1882 y 1935*, Madrid, OEPM.
- PASCUAL, P. (1990), "Desenvolupament econòmic i augment de la circulació mercantil. La configuració històrica del sistema d'intercanvis de l'economia anomenada del segle XIX", *Miscellanea Aqualatensis*, 6, pp. 211-241.
- PASCUAL, P. (1991), *Fabrica i treball a la Igualada de la primera meitat del segle XX*, Barcelona, Publicacions de l'Abadia de Montserrat.
- PASCUAL, P. & FERNÁNDEZ PÉREZ, P. (eds.) (2007), *Del metal al motor. Innovación y atraso en la historia de la industria metal-mecánica española*, Barcelona, Fundación BBVA.
- PIORE, M. J. & SABEL, C. F. (1984), *The Second Industrial Divide. Possibilities for Prosperity*, New York, Basic Books.
- PONCE, G. (2004), "¿Cambio tecnológico o aumento de la competitividad? Las políticas de innovación industrial en la Comunidad Valenciana", *Eria*, 63, pp. 91-106.
- PORTER, M. E. (1990), *The Competitive Advantage of Nations*, New York, Free Press.
- PORTER, M. E. (1998), "Clusters and the New Economics of Competition", *Harvard Business Review*, November-December, pp. 77-90.
- PORTER, M. E. (2000), "Locations, Clusters, and Company Strategy", in CLARK G. L.; FELDMAN, M. P. & GERTLER, M. S. (eds.), pp. 253-274.

- PAVITT, K. (1985), “Patent Statistics as Indicators of Innovative Activities: Possibilities and Problems”, *Scientometrics*, 7, 1-2, pp. 77-99.
- PAVITT, K. (1988), “Uses and Abuses of Patent Statistics”, in VAN RAAN, A. F. J. (ed.), pp. 509-535.
- QUIJADA, P. A. (2010), “Antecedentes sobre el comercio de la nieve en Ibi: una actividad desarrollada entre el siglo XVII y el XX”, *Biblio 3W. Revista Bibliográfica de Geografía y Ciencias Sociales*, XV, 856.
- RAFF, D. & LAMOREUX, N. (eds.) (1995), *Co-ordination and information: historical perspectives on the organisation of Enterprise*, Chicago, University of Chicago Press.
- RAFFAELLI, T.; BECATTINI, G. & DARDI, M. (eds.) (2006), *The Elgar Companion to Alfred Marshall*, Cheltenham, Edward Elgar.
- SABEL, C. & ZEITLIN, J. (1985), “Historical Alternatives to Mass Production: Politics, Markets and Technology in Nineteenth Century Industrialization”, *Past and Present*, 108, pp. 133-176.
- SABEL, C. & ZEITLIN, J. (1997), *World of Possibilities. Flexibility and Mass Production in Western Industrialization*, Cambridge, Cambridge University Press.
- SÁIZ, P. (1999), “Patentes, cambio técnico e industrialización en la España del siglo XIX”, *Revista de Historia Económica*, 17, 2, pp. 265-302.
- SÁIZ, P. (2005), “Investigación y desarrollo: patentes”, in CARRERAS, A. & TAFUNELL, X. (coords.), *Estadísticas históricas de España. Siglos XIX-XX*, vol. II, pp. 835-872.
- SCHMITZ, H. (1995), “Collective efficiency: growth path for small-scale industry”, *The Journal of Development Studies*, 31, pp. 529-566.
- SCHMITZ, H. (1999), “Efficienza collettiva e rendimenti di scala”, in DI TOMMASO, M. R. & RABELLOTTI, R. (eds.), *Efficienza collettiva e sistema d'impresa*, Bologna, Il Mulino, pp. 23-56.
- SCOTT, A. J. (1988), “Flexible production systems and regional development: the rise of new industrial spaces in North America and Western Europe”, *International Journal of Urban and regional Research*, 12, pp. 171-186.
- SIGNORINI, F. L. (1994), “The Price of Prato, or, measuring the industrial district effect”, *Papers in Regional Science*, 73, 4.
- SIGNORINI, F. L. (ed.) (2000), *Lo sviluppo locale. Un'indagine della Banca d'Italia sui distretti industriali*, Rome, Donzelli.
- SIGNORINI, L. F. & OMICCIOLI, M. (eds.) (2005), *Economie locali e competizione globale: il localismo industriale italiano di fronte a nuove sfide*, Bologna, Il Mulino.
- SOKOLOFF, K. (1988), “Inventive activity in early industrial America: evidence from patent records, 1790-1846”, *Journal of Economic History*, 48, pp. 813-850.
- SOLÀ, A. (2004), *Aigua, indústria i fabricants a Manresa (1759-1860)*, Manresa, Centre d'Estudis del Bages.
- SORENSEN, O.; RIVKIN, J. W. & FLEMING, L. (2006), “Complexity, networks and knowledge flow”, *Research Policy*, 35, 7, pp. 994-1017.

- STORPER, M. & SCOTT, A. (1989), "The geographical foundations and social regulation of flexible production complexes", in WOLCH, J. & DEAR, M. (eds.), pp. 21-40.
- TORRAS, J. (1992), "Gremio, familia y cambio económico. Pelaires y tejedores en Igualada, 1695-1765", *Revista de Historia Industrial*, 2, pp. 11-30.
- TORRAS I RIBÉ, J. M. (1974), "Trajectòria d'un procés d'industrialització frustrat. Contribució a l'estudi de la relació entre infraestructura i transformacions industrials", *Miscellanea Aqualatensia*, 2, pp. 151-197.
- TORRÓ, LL. (1994), *Abans de la indústria. Alcoi als inicis del sis-cents*, Alicante, Universidad de Alicante-Institut de Cultura Juan Gil-Albert.
- TORRÓ, LL. (1996), *La Reial Fàbrica de Draps d'Alcoi. Ordenances gremials (segles XVI al XVIII)*, Alcoy, Ajuntament d'Alcoi-Institut de Cultura Juan Gil-Albert.
- VALERO, J. R. (1991), *Payá. Historia social de una industria juguetera*, Valencia, Generalitat Valenciana.
- VALERO, J. R. (1997), *Origen y desarrollo de la industria del juguete en Ibi (1900-1942)*, Alicante, Universidad de Alicante.
- VALERO, J. R.; NAVARRO, A.; MARTÍNEZ, F. & AMAT, J. M. (1992), *Elda, 1832-1980: industria del calzado y transformación social*, Alicante, Instituto de Cultura Juan Gil-Albert.
- VALLÈS, I. (1986), *Indústria tèxtil i societat a la regió Alcoi-Ontinyent 1780-1930*, Valencia, Universidad de Valencia.
- VAN RAAN, A. F. J. (ed.) (1988), *Handbook of Quantitative Studies of Science and Technology*, Amsterdam, Elsevier Science Publishers.
- VIRÓS, LL. (ed.) (2002), *La indústria tèxtil: Actes de les V Jornades d'Arqueologia Industrial de Catalunya*, Barcelona, Associació d'Enginyers industrials de Catalunya.
- VIRÓS, LL. (2009), "Dumpers españoles en el mundo. El proceso de internacionalización de AUSA (1956-2005)", *Revista de Historia Industrial*, 40, pp. 125-154.
- WOLCH, J. & DEAR, M. (eds.) (1989), *The power of geography: how territory shapes social life*, Boston, Unwin Hyman.
- YBARRA, J. A. & SANTA MARÍA, M. J. (2008), "El Distrito de Juguete de la Foia de Castilla y su Evolución", *Mediterráneo Económico*, 13, pp. 409-431.
- YBARRA, J. A.; SANTA MARÍA, M. J.; GINER, J. M. & FUSTER, A. (2008), *Mapa de áreas de cambio e innovación en la Comunidad Valenciana*, Alicante, Universidad de Alicante.
- ZEITLIN, J. (2007), "Industrial districts and regional clusters", in JONES, G. & ZEITLIN, J. (eds.), pp. 219-243.



Technological Innovation in Industrial Districts in Spain During the First Third of the 20th Century

ABSTRACT

The aim of this study is to determine whether the high level of technological innovation detected in Spain's industrial districts is, as the theory states, an intrinsic characteristic of these districts that was present in all stages of their evolution. To that end, and using figures on the number of patents filed, the trajectory of innovation is analysed for the 1878-1935 period for ten of the main industrial districts in Spain that had already become industrial districts in the early 20th century. The result supports the thesis that the capacity to innovate is an essential characteristic of industrial districts and clusters, but also shows that there were large differences between them in their propensity to innovate, linked to differences in human capital, sectoral specialisation and proximity to environments with a higher level of technological knowledge, among other factors.

KEYWORDS: industrial districts, technological innovation, patents, economic history

JEL CODES: N63, N64, O33, R12



Innovación tecnológica en los distritos industriales de España durante el primer tercio del siglo XX

RESUMEN

Nuestro trabajo intenta comprobar si la elevada innovación tecnológica que se ha detectado en los distritos industriales españoles es, como afirma la teoría, una característica intrínseca de los distritos, presente en todas las fases de su evolución. Para ello, con los datos del registro de patentes, se analiza la trayectoria innovadora durante el periodo 1878-1935 de diez de los principales distritos industriales españoles que ya estaban configurados como tales a principios del siglo XX. El resultado respalda la tesis de que la capacidad de innovación es una característica esencial de los distritos y clústeres industriales, pero también demuestra que existieron grandes diferencias entre ellos en la propensión a innovar, vinculadas, entre otros factores, a la distinta dotación de capital humano, la especialización sectorial y la proximidad a entornos con mayor nivel de conocimiento tecnológico.

PALABRAS CLAVE: Distritos industriales, innovación tecnológica, patentes, historia económica

CÓDIGOS JEL: N63, N64, O33, R12