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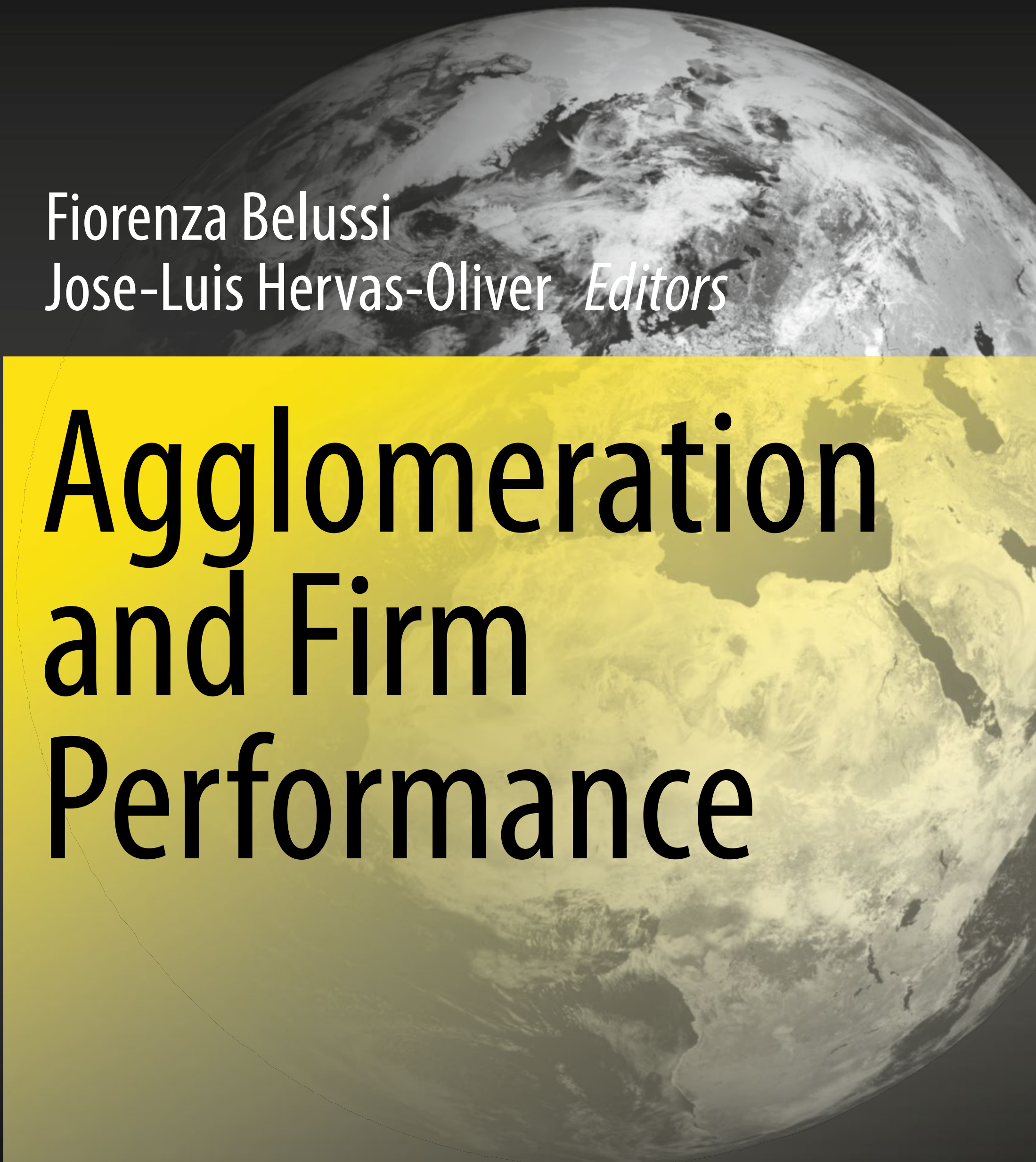
Agglomeration and Firm Performance



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Agglomeration and Firm Performance

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Cluster Advantage and Firm Performance: A Shift into the Future!

Jose-Luis Hervas-Oliver and Fiorenza Belussi

1 Introduction

The spatial concentration or agglomeration of economic activity leads to the emergence of externalities in the form of collective resource pools. These common pools constitute an important source of external knowledge (Marshall and Marshall 1920) which enables and helps to sustain a firm's competitive advantage (Porter 1998). Scholars have suggested that localization is linked to increasing returns and better innovation because of access to *localization externalities* and *increasing returns* (e.g. Arrow 1962; Marshall and Marshall 1920; Porter 1998; Arthur 1994). Localization externalities[1] are defined as the fact that the concentration of an industry in a specific location or region promotes knowledge spillovers between firms and facilitates innovation within that particular industry in that location. Localization externalities allow geographically concentrated firms in the same industry to learn from one another and to exchange ideas. They also foster imitation, business interactions and the access to external knowledge and resources without monetary transactions

[1]Marshall (1890), Arrow (1962) and Romer (1986) put forward a concept, which was later formalized by the seminal work of Glaeser et al. (1992) and became known as the Marshall-Arrow-Romer (MAR) mode.

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(e.g. Brusco 1982; Piore and Sabel 1984; Saxenian 1994), that is, the unintentional and uncompensated exchange of knowledge among firms, thereby helping to configure firms specific capabilities and increasing returns (e.g. Marshall 1890: 32; Saxenian 1994; Belussi et al. 2003). These studies, however, have generally been based on the meso-level, without exploring firms as a specific unit of analysis. This contributed volume offers a new perspective and contributes to reduce this theoretical gap by focusing principally on the firm level, that is, considering firms as a unit of analysis when studying agglomerations.

The Marshallian "knowledge-in-the-air" idea has started to be questioned by scholars that do not take it for granted but have tested agglomeration effects, their dynamics and how each co-located firm gains from them differently (e.g. Hervas-Oliver et al. 2018; Wang et al. 2014), mainly from management strands of literature. For instance, Alcacer and Chung (2014) study how firms gain positive effects from agglomerations, refining for the type of particular asset accessed (labour, knowledge, suppliers) and finding a great deal of heterogeneity. Wang et al. (2014) evidence agglomeration effects and their dynamics throughout different cluster stages. Similarly, there is evidence of negative effects from agglomerations, such as *cognitive inertia* (Pouder and St. John 1996) or even negative performance effects (Sorenson and Audia 2000). All in all, despite assuming that clusters/industrial districts produce benefits, many nuances remain inconclusive. In particular, those referred to agglomeration effects and (collocated) firms' performance, both at the *meso*- and *micro*-level, constitute the core of this contributed volume.

In particular, the aim of this contributed volume consists of extending our understanding about the effect that agglomeration exerts on *firms' innovation and performance*. Despite the existing rich literature on the effects of agglomeration on performance, especially on related variety and regional innovation systems, most of the research on agglomerations has been mainly devoted to the understanding of regions and clusters, rather than considering firms as a unit of analysis. In fact, the effect of agglomeration on firms is less researched, as Shaver and Flyer (2000) and Boschma and Frenken (2011) pointed out that the topic is a potential research avenue or emerging topic.

> As firms are heterogeneous in their routines and capabilities, it is likely that the costs and benefits that firms enjoy from co-location differ. In particular, more knowledge-intensive firms have more to lose and less to gain from local knowledge spillovers than firms that are less knowledge intensive. Indeed, there is evidence that the extent to which firms profit from MAR externalities falls when their level of knowledge increases.

Specifically, in the Boschma and Frenken (2011) quote, it is observed that agglomerations exert gains and losses, and firms in agglomerations present asymmetric gains. In this volume, we address the two phenomena attempting to extend and enrich the clusters/industrial districts literature. In doing so, we also connect both topics to the general ongoing debate on cluster evolution and resilience (Belussi and Sedita 2009; Boschma and Dirk Fornahl 2011; Hervás-Oliver et al. 2017; Belussi and Hervàs-Oliver 2017).

2 The Effects of Agglomeration on Firms' Performance: Positive or Negative?

Agglomeration can generate gains, but not always. There are studies, however, which have found localization has no effect or even negative effects on performance (e.g. Gilbert et al. 2008), while others have found the link to be positive (e.g. McCann and Folta 2011). Our contributed volume disentangles this paradox and offers high value to clarify it. When do agglomerations present negative or even no effects? What are these effects from agglomerations?

Connecting to this idea, in Part I, a critical survey of the literature by **Fornahl, Grashof and Söllner** analyse the effects inside and outside clusters identified in empirical studies in order to understand when the cluster effects are positive or negative. Similarly, in Chapter "Pathways of innovation: The I-district effect revisited", **Boix, Galleto and Sforzi**, from the Marshallian-Becattini perspective, revisit empirically the industrial district effect, understood as a dynamic efficiency in Marshallian industrial districts in the form of a positive innovative differential compared to the normal performance obtained by firms in the economy. Their results refine existing knowledge on this topic. Afterwards, **Jankowska and Götz** show, empirically, the role of cluster institutions in pursuing the internationalisation processes. They focus on innovation as a mediating variable, triggering the internationalisation of firms, thanks to their analysis of a truly operating cluster. Lastly, closing Part I, **Barzotto and Mariotti** shed light on the contribution of inward FDIs on the IDs' socio-economic resources, presenting a piece of empirical research that focuses on the skilled workforce, which is considered one of the most common critical factors in industry. It is investigated whether, within the industrial districts, the affiliates of foreign MNEs differ from national firms in terms of labour workforce skill composition.

3 Agglomerations and Firms' Asymmetric Gains

In Part II, assuming that agglomerations may create gains, if they do, and focusing on the firm level, how does this work, and how are those gains distributed throughout agglomerated firms? Again, there is some preliminary evidence that not all firms benefit equally from being located in an agglomeration (e.g. Chung and Kalnins 2001; McCann and Folta 2011; Hervas-Oliver et al. 2018; Hervás-Oliver et al. 2017). Put differently, are externalities asymmetrically gained within agglomerations by co-located firms? **Hervas-Oliver, Manjarres-Henríquez and Boronat-Moll** have studied industrial district evolution and the technological impacts that induce inertia or revolutionary change. Distinguishing between sustaining and radical innovations within industrial districts, their study helps to answer *why* and *how* districts evolve, analysing types of technological changes and the firms that participate. Then, addressing the specific research question about who really wins within clusters, an interdisciplinary team from Spain and USA, **Peiró, Segarra-Oña, Verma and Millet**, have provided solid empirical evidence and in-depth analysis of the cluster effect on hotels' performances, presenting an interesting set of service firms (hotels) and their strategies to gain the most from co-location in agglomerations. In the same line of research, **Annalisa Caloffi, Luciana Lazzeretti and Silvia Rita Sedita** explore in an original manner the evolutionary trajectories of the cluster concept over time through the application of analytical tools coming from the realm of *bibliometric* analysis and social network analysis. This analysis confirms the interdisciplinary character of the cluster concept, with the presence of publication outlets from different research fields. However, they demonstrate that the contribution of management and innovation studies increases over time. The longitudinal analysis of the keywords confirms this trend and reveals that the cluster literature is evolving from economic and sociological-related issues to management-related topics, where innovation and firm performance are the leading issues.

Broadening the realm of agglomerations and considering also science parks, **Díez-Vial and Montoro-Sánchez** establish that science parks are environments that favour agglomeration benefits such as innovation, as they provide the physical and social infrastructures that stimulate the creation and dissemination of new knowledge, encouraging partnerships between universities, firms and the management of the park itself that improve their learning abilities and capacity for innovation. Thus, this work analyses the role of the science parks as knowledge enablers throughout time, evaluating both the evolution of the internal characteristics of the firms and the network locally developed.

Belussi and Caloffi present an analysis of the long-term development of the footwear industry in Italy and Turkey, focusing in particular on their main industrial districts/cluster: one in Italy and three in Turkey. This study contributes to the reflection on the evolving relationship between history-dependent localization externalities and firm performances. Agglomeration benefits do exist in the various stages of the cluster life cycle. However, not all firms benefit equally from being in a cluster, and not all firms show an accelerated pattern of growth after being located in a cluster. Findings reveal that after the take-off and the cluster's emergence, the dynamics of clusters is driven by the ability of some leading firms to connect the cluster (and its internal supply chains) to external markets and to global knowledge sources. Closing Part II, **Belso, Lopez-Sánchez and Mateu-García** point out that, structures within industrial clusters have been forced to change in order to remain competitive within the globalization context. For years, local supporting organisations have been focused on strengthening cluster networks, providing specialized services and fostering innovation practices. Nowadays, thanks to their increasing connectivity, supporting organizations have become hybridizers and catalysers of knowledge that spread among local firms after an intense process of refinement. Acting as mediators between local firms and gatekeepers of extra-cluster knowledge, they smooth firms' access to fresh knowledge and nourish the innovativeness of the system. Using data collected in the Toy Valley cluster during 2014, this study has looked at the mechanisms allowing supporting organisations to successfully diffuse knowledge and pays attention to these two in-between positions. Findings corroborate the particular relevance of facilitators of knowledge. However, important differences emerge when considering the profile of the local organization and the type of knowledge shared.

4 Agglomerations, Recessions and Turnarounds

In Part III, addressing shocks at clusters and industrial districts, from natural disasters to economic crisis, resilience and cluster turnaround are analysed, including smart specialization policies for supporting clustering processes. Starting with **Bellandi, De Propris and Santini,** their study draws on the interpretative arguments related to the endogenous processes of innovation and systemic mechanisms of longevity and long-term competitiveness in industrial districts and local production systems. Thus, this study performs a critical review of the recent contributions on this topic, allowing a novel understanding of how—under certain conditions—local production systems can benefit from endogenous rerouting, especially in the face of the recent technological changes forcefully impacting on traditional industrial organisations. The activation of latent mechanisms of transition may recombine embedded competences and useful knowledge to deliver pathfinding economic solutions that create new competitive advantages and allow longevity to local production systems. Next, **Cainelli, Frascasso and Vittucci** develop, in a virtual "nutshell", a study which attempts to assess whether the location of a firm within an industrial district mitigates or exacerbates the impact of a disaster on the firm's activity and performance. They use a firm-level analysis, which shows that clusters, and industrial districts, are amplifying the effect of external shocks, thanks to the multiplication of the channels of transmission.

Focusing on the 2008 recession, both in Spain and Italy, and addressing clusters as a central point, **Gonzalez-Bravo, López and Valdaliso** analyse in Spain to what extent firms' belonging to cluster associations can "shelter" from adverse economic scenarios and promote a better recovery, when economic conditions begin to improve. Similarly, **Brunello and Langella**, using a "difference-in-differences" approach, show that the share of entrepreneurs in Italy declined more in industrial districts, than in comparable labour markets, during the 3 years followed by the 2008 recession. After alternative explanations of this finding have been considered, the study's conclusion is consistent with the idea that intense social interactions—typical of industrial districts—act as a multiplier that amplifies the response to shocks. However, the study cannot exclude that this may translate into a positive effect on employment, as the flows of people, from being entrepreneurs or managers to become employees, appear to be greater, within industrial districts. Finally, **Belussi and Trippl,** studying cluster policies within the context of smart specialisation, in a representative sample of 16 EU regions (advances, intermediated or less-developed;

De Noni et al. 2017; Belussi et al. 2018), provide a very extensive, and elaborated frame, on the efficacy of smart specialization policies in extending, upgrading and renewing clusters. This has a paramount importance for understanding the connection between the spontaneous and market-driven, firms' "order" and the policy-induced new strategies, which, benefiting from significant public new resources devoted to innovation, can militate for resilience and new path creations.

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Part I
Agglomerations and Performance

Effects of Being Located in a Cluster on Economic Actors

Dirk Fornahl, Nils Grashof, and Cathrin Söllner

Abstract The greatest assets of clusters are their positive external effects or knowledge spillovers generated through the colocation of firms of the same or similar industries. These externalities can have a positive influence on various performance indicators, not only for firms inside clusters but for the entire region in which clusters are embedded as well. However, several empirical studies show that these positive results do not always manifest themselves. Moderating effects such as industry- or country-specific as well as cluster- and firm-specific characteristics play important roles. Therefore, the goal of this chapter is to provide an overview on the effects both inside and outside of clusters identified in empirical studies, thereby investigating the following indicators: innovativeness, productivity, employment growth and wage level, entrepreneurship, survival probability and growth of start-ups as well as resilience.

Keywords Cluster effect · Firm performance · Regional development · Externalities

1 Introduction

Examining modern economies without considering clusters seems absurd in the twenty-first century. According to the European Cluster Observatory, within the European Union (EU), 2000 statistically relevant clusters employ nearly 40% of the European workforce. In light of the success of some clusters, for example, Silicon Valley, economic policymakers are motivated to foster cluster initiatives in order to write a similar success story for their region (Brown et al. 2007; Festing et al. 2012).

A vast amount of scientific literature underpins the widespread application of the cluster concept.[1] Since the work of Marshall (1890), several researchers from varying disciplines have analysed the cluster phenomenon and its positive economic

[1]For a detailed overview, see, for example, McCann and Folta (2008) and Sedita et al. (2012).

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effects on regional development as well as on firm performance (McCann and Folta 2008; Lee 2009). However, although the cluster concept is popular amongst scientists and politicians, until now there are no clear results regarding the effects of a cluster. Indeed, several empirical studies deal with the effects of a cluster by analysing various dependent variables such as productivity or innovativeness, but they reach highly contrary conclusions (Fornahl et al. 2015; Hervas-Oliver and Sempere-Ripoll 2014; Knoben et al. 2016).

Given the already high financial support of cluster activities by national governments, the EU and other public institutions, it is astonishing that the empirical results regarding cluster effects remain so unclear (Brown et al. 2007; EFI 2015; Martin et al. 2008). Before fostering cluster initiatives, it is reasonable to first analyse in detail whether a positive cluster effect can be empirically identified or, as Maier and Trippl (2012) state: "In an economy where the agglomeration of activities does not generate any benefits, a policy that attempts to generate such agglomerations does not make any sense" (Maier and Trippl 2012, p. 14).

Therefore, the aim of this chapter is to provide a detailed overview and a systematic discussion of the effects inside and outside clusters, concentrating on clusters that have been analysed in quantitative studies.[2] In terms of the effects, we focus on the innovativeness, productivity, employment growth and wage level, entrepreneurship, survival probability and growth of start-ups and finally resilience. The discussion will consider various types of moderating variables in order to offer some explanations for the conflicting empirical results.

Although the term cluster is a widespread and prevalent theme in economics, there are still fundamental differences in its definition as well as in understanding. As a consequence of the unclear definitional delimitation, the term has proliferated considerably (Brown et al. 2007; Martin and Sunley 2003; Sedita et al. 2012). Thus, it is essential that the considered empirical studies are all based on a similar cluster understanding. Building on Porter (2000) this chapter defines clusters as "(. . .) geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate" (Porter 2000, p. 15). Not all empirical studies considered here employ this definition directly. However, a paper can only be selected if it also mentions the three central elements of Porter's cluster definition, namely, the spatial connection, the sectoral connection as well as interdependencies. In this sense and in line with several authors (Delgado et al. 2010; McCann and Folta 2011), the terms cluster and agglomeration are used interchangeably.

The chapter ends with a short conclusion highlighting promising areas for further investigation.

[2]The authors however recognize that there also is a vast amount of case studies dealing with the effects of being located in a cluster (e.g. Saxenian 1994).

2 Effects Inside and Outside Clusters

There are several mechanisms which create cluster externalities and therefore have a positive influence on innovativeness, productivity and other dependent variables (Fornahl et al. 2015). The following section will investigate whether the effects of the postulated mechanisms on central outcome variables can be empirically identified.

2.1 Effects of Clusters on Innovativeness

Starting with innovativeness, it is generally argued that clusters are an important source of innovativeness (OECD 2009). Several empirical studies show that companies localized in a cluster experience higher innovation rates than those outside clusters (Baptista and Swann 1998; Bell 2005). Likewise, regions with clusters demonstrate higher innovation rates than those without clusters (Delgado et al. 2012; Porter 2003; Spencer et al. 2010). In this context particularly the labour mobility, knowledge spillovers and the relatively high degree of competition within clusters are potential reasons for a positive impact on innovativeness (Fornahl et al. 2015).

Nevertheless, at this point it must be highlighted that the degree of the effects varies considerably amongst the empirical studies (Fang 2015; Fornahl et al. 2015; Lee 2009). Two important factors involve the age and size of the cluster as indicators for the phase of the cluster life cycle. In their empirical study, Audretsch and Feldman (1996) compare the propensity for innovative activities in 210 different industries, taking the specific phase of the life cycle into account. Their results show that geographically concentrated companies experience above average innovation rates during the early stage of the industry. However, during the mature and declining stages, the opposite is true. In the latter stages, companies outside clusters tend to be more innovative than companies within clusters. The authors conclude that the positive agglomeration effects during the early stages are replaced by congestion effects during the latter stages of the industry life cycle (Audretsch and Feldman 1996).

In addition to this, Folta et al. (2006) highlight the importance of the cluster size. Indeed, they assert a positive relationship between cluster size and innovativeness, but they emphasize at the same time that after exceeding a specific cluster size (in their case 65 companies), this positive effect diminishes due to diseconomies of agglomeration.

The cluster-innovation relationship is therefore more complex than just a simple locational effect. In other words, clustering per se is not sufficient for a higher innovative performance. Instead there are several moderating effects which influence this relationship in one way or another (Beaudry and Breschi 2003; Fang 2015; Lee 2009).

Beaudry and Breschi (2003) find that a company is more likely to innovate if it is located in a region where a large knowledge stock exists and where the concentration of innovative companies from the same industry is high. On the contrary, the strong presence of non-innovative companies from the same industry implies intense disadvantages for the innovativeness (Beaudry and Breschi 2003). The work of Hervas-Oliver and Sempere-Ripoll (2014) goes one step further. They analysed a large dataset of 6697 companies across 23 industries. On the one hand, they show that a location in an agglomeration, here defined in line with Porter's cluster definition (2000), indeed has a positive influence on a firm's absorptive capacity (the firm's ability to scan, evaluate and integrate external knowledge) and in general on innovativeness. On the other hand, however, they emphasize that not all companies benefit equally from being located in an agglomeration. Instead, whether a company can profit more or less from being located within an agglomeration depends on the firm-specific innovation capabilities. Knowledge-rich companies contribute the most to agglomeration externalities but gain the least. Conversely, the least innovative companies gain the most from agglomeration externalities. They explain this asymmetric distribution through involuntary knowledge spillovers by the knowledge-rich companies (Hervas-Oliver and Sempere-Ripoll 2014). Both results are in line with the theoretical argument of an adverse selection within clusters, meaning that "good" companies have no incentive to enter a cluster (Shaver and Flyer 2000). Nevertheless, there are several studies which show that these "good" companies, in terms of adequate resources and capabilities, are the ones which may be able to extract more from the externalities present in an agglomeration. Thus, in the end it is also reasonable to assume that these "good" companies might be able to gain more knowledge than they lose due to knowledge spillovers (Expósito-Langa et al. 2015; Hervas-Oliver and Albors-Garrigos 2009; McCann and Folta 2008).

The empirical studies mentioned above make clear that being located in a cluster does not automatically imply a positive effect on the firm's innovativeness. Instead it can perhaps be a potential source for negative externalities. In order to analyse the cluster-innovation relationship in a suitable way, it is essential to consider industry-/country-specific, cluster-specific and firm-specific characteristics which may moderate the cluster effect on innovativeness (Fang 2015; Fornahl et al. 2015; Lee 2009).

2.2 *Effects of Clusters on Productivity*

In addition to innovativeness, clusters' effects on productivity are of significant scientific interest. In general, it has been argued that clusters have a positive influence on firm's productivity, amongst others, due to intense cooperation between companies within clusters (Borowiecki 2013; Cainelli 2008; OECD 2009). The authors Borowiecki (2013), Basant et al. (2011) and Ketels and Protsiv (2013) prove that companies located in clusters have a higher productivity than companies outside clusters.

Despite these and other studies which show a direct effect, evidence for a moderating effect by other variables exists as well. In their recent paper, Knoben et al. (2016) analyse the agglomeration-productivity relationship by controlling for heterogeneity on the agglomeration level (level of urbanization, level of specialization, level of knowledge intensity) and on the firm level (firm size, the strength of a firm's internal knowledge base, the level of local connectedness). Differing from what other studies implicitly or explicitly have assumed, they show that there are important differences between the types of companies that benefit from particular types of agglomeration dimensions. They find evidence that the firm size is an inverted U-shaped moderator of the agglomeration-productivity relationship. On the one hand, relatively small companies tend to lack the necessary capabilities to internalize external resources. On the other hand, relatively large companies show certain inertia. This means that due to the increasing complexity of these companies, their openness to their environment, as well as their flexibility, is reduced consequently preventing them from effectively integrating external resources into their existing resource stock. Furthermore, they point out that, apart from the firm size, the level of local connectedness is also an inverted U-shaped moderator. In general, the source of the benefit of collaborating with other companies in the same region refers to the fact that geographical proximity facilitates face-to-face interactions which in turn foster the exchange of tacit knowledge. As such, having a relatively high share of local connections allows companies to better extract resources from their environment. Yet companies also need relationships with distant partners. Missing external linkages can lead to a (technological) lock-in or inertia. The higher the level of local connectedness, the fewer resources can be spent by a company in order to connect with companies outside the cluster. Therefore, in both cases a moderated level supports a positive relationship between agglomeration and productivity. In their sample, this relationship, however, turns out to be negative for many companies, as they are not capable of realizing the possible advantages of an agglomeration and simultaneously suffer from disadvantages such as diseconomies of agglomeration, crowding effects and increased local competition (Knoben et al. 2016).

Rigby and Brown (2015) reach a slightly different conclusion. Similar to the work of Knoben et al. (2016), they control for various firm-level characteristics. However, even though they also recognize differences in the degree of the effect, virtually all companies gain productivity benefits (Rigby and Brown 2015). For example, the benefits are larger for small and young businesses which are positively affected by numbers of firms in their own industry within a 5 km radius, whereas older firms gain the most from having upstream suppliers nearby.

Martin et al. (2008) detect similar results, finding evidence for a positive, although weak, effect on productivity. They highlight that the size of clusters is an important variable which moderates the effect on productivity. After exceeding a particular size, the productivity gains from being located in a cluster diminish (Martin et al. 2008).

In the end, it is obvious that several variables moderate the cluster-productivity relationship. It can be argued that clusters can have a rather positive as well as a rather negative effect on productivity. As Knoben et al. (2016) describe it: “One firm’s medicine may indeed be another firm’s poison” (Knoben et al. 2016, p. 148).

2.3 Effects of Clusters on Employment Growth and Wage Level

Several studies have shown that clusters have a positive effect on employment growth and the average wage level—not only inside the cluster itself but in the broader industrial environment (e.g. firms that are connected through value creation linkages) or even the region as well (OECD 2009; Wennberg and Lindqvist 2010; Spencer et al. 2010). Several factors can be identified which contribute to these effects. These elements include the clustering intensity, the reduction of costs due to geographical proximity (e.g. for the production or the exchange of products, services, knowledge) or the specialized infrastructure (e.g. training institutions) (Wrobel 2015; Delgado et al. 2012).

A variety of case studies of different countries and industries offer a wide range of empirical evidence as to how the positive influence of a cluster on employment numbers depends on several variables and thus cannot be generalized. Mcdonald et al. (2007) examined clusters in the United Kingdom and demonstrated that employment growth tends to be more significant in established clusters.

Additionally, affiliation to a particular industry seems to have a significant influence, as Spencer et al. (2010) showed in their study of 300 industries in Canada. In this case, with the exception of the manufacturing branch, employment growth on average is higher in firms within clusters compared to firms in non-cluster locations. Another important factor is the local environment of a cluster. Being embedded in an environment close to a (big) city correlates with a higher rate of employment growth. Nevertheless, it must be emphasized that in addition to being located close to population hot spots, the industrial landscape of a region should not be neglected (Spencer et al. 2010). Finally, an increasing specialization level of a cluster is positively associated with employment growth, whereas industry specialization has a rather negative impact (Delgado et al. 2012). Mcdonald et al. (2007) came to a similar conclusion, finding that the depth of a cluster does not have a significant influence on the employment growth inside clusters.

Taking a closer look at the wage level inside clusters, one finds similar results to those obtained for employment growth, amongst other things due to the fact that both effects depend on the overall economic performance of the cluster. For the most part, there is empirical evidence showing that the average wage level is distinctly higher in cluster-integrated firms than for those outside of it (Porter 2003; Spencer et al. 2010). Additionally, it is prudent to always consider these effects in combination, as, e.g., employment growth on its own does not allow for any conclusions about the quality of the created jobs (Wennberg and Lindqvist 2010).

As for employment growth, an established cluster, thereby embedded and linked closely to local players, has a positive impact on wages (Ketels and Protsiv 2013).

Similar are the findings regarding the influence of the industry, showing that in most industries, the wage level was significantly higher in firms inside the cluster than outside. The exception was the agricultural sector, where the income was 9.5% lower on average in cluster-internal firms. The significance of the local characteristics shows a corresponding positive effect on mean salary as well as on employment growth, the effect in urban areas being higher (Spencer et al. 2010). However, other correlating factors, such as the cost of living or regionally differing house prices, should not be neglected, as they might urge firms to pay higher salaries (Porter 2003; Wennberg and Lindqvist 2010). As far as the environment of the cluster is concerned, being situated close to an urban area has a positive effect on mean salary, similar to the effect on employment growth. Finally, being embedded in a strong cluster generates a higher wage level on average in a cluster than when a firm is simply part of an agglomerated industry (Wennberg and Lindqvist 2010; Ketels and Protsiv 2013).

Apart from the described (positive) effects on firms inside the cluster, reciprocal influences between clusters and the economic performance of their geographical surroundings can also be observed. Thus, Delgado et al. (2012) show in their study of US clusters for the years 1990–2005, in which they combined various data sources, the positive impact of clusters on regional performance that revealed itself, amongst other things, in the creation of jobs and higher salaries. Spencer et al. (2010) identify a positive correlation of cluster employment and regional employment growth in their study as well and an even stronger positive correlation between cluster employment and regional wage level. Finally, Ketels and Protsiv (2013) show the connection between (strong) clusters and the mean income, thereby concluding from this that clusters foster regional productivity and consequently can help to improve a region's competitive position. Conversely, of course the region can influence clusters as well, shown above in the example of the local factor environment.

It can be concluded that being located in a cluster has a rather positive influence on employment and on the average wage level, both on firms inside and outside clusters (but located in the same area). Still there are many variables, which moderate this influence and, thus, lead to varying degrees of impacts in different regions, industries or environments.

2.4 Effects of Clusters on Entrepreneurship, Survival Probability and Growth of Start-Ups

There has been a great deal of research showing how clusters positively influence entrepreneurship and particularly start-up activities (Delgado et al. 2010), though the key reasons for these connections have not been identified yet. The reasons that have been presented thus far that explain this positive impact cover a broad field of variables. Apart from the expected higher probability of finding an idea in a cluster, it is anticipated that the motivation to start a new business is higher if one is surrounded by entrepreneurial role models. Moreover, in a cluster one has a basic general support by the existing institutions and a pool of specialized human capital and infrastructures are available. Finally, research identifies geographically concentrated demand of certain products and services as a favourable factor for entrepreneurship and its development (Cooper and Folta 2000; Fornahl 2003; Fornahl and Menzel 2003; Fornahl and Sorenson 2008; OECD 2009).

One of the main variables moderating the cluster's effects on entrepreneurship is the industry. In his study of industries located in the Appalachian region, Feser (2008) underlines its importance, showing that particularly technology-intensive clusters (e.g. information or communication technology or software) exert a strongly positive effect. The OECD study (2009) identified similar results for the Grenoble cluster in France, showing that highly innovative clusters lead to a great number of spin-offs. Still, one must be careful generalizing these findings, as a missing entrepreneurial culture, the lack of knowledge exchange between industry and research or a deficient amount of risk capital in a cluster can restrain the opportunities for founding numbers. Stuart and Sorenson (2003) studied biotechnological clusters in the USA, finding that clusters foster spin-offs, especially when the industry is older and, consequently, there are more and bigger firms present. However, they simultaneously show that when many firms are already settled, this inhibits the performance of the start-ups thereby measured by the probability to go public and raise funds. This leads to the survival probability of start-ups, which—if following Wennberg and Lindqvist (2010)—is significantly positively influenced if they are located in an industrial cluster. Reasons for this include the high productivity and the strong regional network of the cluster as well as the local demand (Borowiecki 2013; Frenken et al. 2013; Wennberg and Lindqvist 2010). Moreover, start-ups in clusters profit from knowledge spillover between the local actors. These can help start-ups to increase their innovativeness. Additionally, a cluster's already settled clientele can be exploited quickly through networking and cooperation (Delgado et al. 2010; Frenken et al. 2013; Wrobel 2015). However, Sorenson and Audia (2000) present a counterexample, revealing a higher failure rate of start-ups in the shoe manufacturing industry if they were located geographically close to a dense concentration of other manufacturers. Amongst other things, this was caused by a high level of competition for local resources. The results of the influence on growth are more heterogeneous because different factors are analysed depending on the stage of cluster development, ranging from a clearly positive impact to a rather negative one (Stuart and Sorenson 2003; Wennberg and Lindqvist 2010). Again, different cluster externalities vary in their (positive) impact. For example, the greater the cluster's specialization, the higher the growth rate of start-up activities (Delgado et al. 2010).

Studies investigating entrepreneurial activities in the geographic area surrounding a cluster are rather scarce. Delgado et al. (2010) find evidence that strong clusters support the start-up scene in their regional surroundings as well as in related co-located clusters, leading to an increasing number of new firms. Especially important here are the interregional knowledge and technical spillovers, differing in extent and type, which reduce costs and risks of starting a new business.

To sum up, it can be noted that clusters have rather positive effects on entrepreneurship, which however can vary depending on the industry, the innovativeness, the entrepreneurial culture in a cluster as well as the presence of big companies. On the one hand, there is some evidence in the literature that, apart from fostering the founding of new firms, clusters foster their survival and growth due to strong regional networks, an established clientele or internal cluster spillovers. On the other hand, being located in a cluster can have negative impacts on the growth of new firms, as they, e.g., immediately face competition.

2.5 Effects of Clusters on Firms Surviving

Firms surviving is another factor that is influenced by clusters. As to how a region's economy resists, responds to or recovers from a shock depends on a wide range of aspects. These range from the general regional economic structure; the institutional, cultural, entrepreneurial and innovative atmosphere; and the governance and the political settings in which the cluster is embedded to the internal and external linkages of the single firms (Martin 2011). According to Martin (2011) four dimensions of resilience can be observed in the event of a recessional shock: resistance, recovery, reorientation and renewal. While the last three phases are influenced by a combination of the above-mentioned variables, how a cluster resists in the beginning is determined particularly by the variety or diversity of the economic structure. This is the case because the various branches are likely to respond differently to external changes. Still, diversity alone does not assure a high resistance, as the connectedness and the number and strength of (in-)direct ties amongst the different sectors can vary significantly. Taking a more evolutionary perspective, Simmie and Martin (2010) applied the adaptive cycle to a regional economic system. The model consists of four phases that are all influenced by the following aspects, varying in their extent and determined by their respective historical development:

1. The totality of the usable resources of the system (competences of the firms and their employees, the hard and soft infrastructure and the overall institutional framework of the economic structure)
2. The internal network (traded and untraded interdependencies, including various factors such as trust, knowledge spillovers, labour mobility or supply inputs)
3. Resilience (how reactive a cluster can be influenced by all levels of the cluster environment: the readiness of workers to adapt, the innovative and entrepreneurial capabilities of the firms, the accessibility of financial support and the capability of the institutional framework to adapt and innovate)

Also taking an evolutionary perspective, Boschma (2015) considered time as a key factor and, consequently, emphasized the role of the historic development of networks as well as the institutional and industrial structures.

Wrobel (2015) examined the German mechanical engineering industry and found that firms in clusters are more resilient than non-cluster firms. However, this finding is based only on his investigation of employment trends. Still, his results are congruent with the results of Cainelli et al. (2012), who investigated manufacturing sectors in various Italian provinces over a 12-year period. They found evidence that industry specialization, urbanization economies and a certain (un)related variety have a positive impact on resilience. A higher industry specialization leads to stronger Marshallian externalities, which, again, affect productivity and thereby reduce firms' exit rates. However, this positive effect changes into a negative one once a certain point has been reached. Urbanization economies as a part of agglomeration economies are expressed in the density of a province's population, thus supporting firms in overcoming crisis through institutional leverages. Finally, (un) related variety is seen as an enhancing factor for knowledge spillovers, leading to increased longevity. Additionally, Delgado et al. (2015) found evidence that stronger clusters are more resilient and their firms recover faster after a recession period, irrespective of the amount of larger firms in the cluster.

Still, there are other sources that show cluster firms to be less resilient than others in certain circumstances. One example is Martin et al. (2014), who examined French clusters, revealing that firms in competitiveness clusters[3] are more afflicted by recessions than outside firms due to the fact that cluster firms depend more on the performance of the leading firms.

Regarding how the resilience of a cluster influences or is influenced by the region in which it is embedded, or the industries to which single cluster firms are linked, there is still little quantitative evidence. However, qualitative studies recognize some interdependencies between clusters and their wider surroundings that affect their resilience and which are based on knowledge exchange processes (Boschma 2015). Likewise, Martin (2011) names the external openness as a factor that reinforces the resilience capacity of firms inside a cluster.

Considering all of the issues described above, one can conclude that resilience is positively influenced by clusters, though one always must consider moderating factors such as the phase of the cluster life cycle, the general regional economic structure and the framing political settings.

3 Conclusion

After providing a detailed overview and systematic discussion about the effects inside and outside of clusters, there is indeed evidence for a positive cluster effect on various dependent variables, for example, productivity. Nevertheless, it also becomes clear that the cluster effect is far more complex than simply a direct effect. There are several moderating variables, some of which are listed in Table 1, which influence the effect of clusters in one way or another. Moreover, one must consider that a cluster is a complex system in which the various elements are interconnected and hence cannot be interpreted as isolated influencing factors. Additionally, clusters themselves may be embedded not only in the regional environment but in larger networks as well, these thus influencing the interdependencies mentioned above once again (e.g. Fang 2015; Litzel 2017).

[3]Clusters that benefited from the public support "poles de competitivité", which started in 2005 (Martin et al. 2014).

Table 1 Cluster effects and their moderating variables (own compilation)

Effect	Source	Results of empirical studies	Influenced by
Innovativeness	Audretsch and Feldman (1996)	Heterogeneous results	• Stage of the industry life cycle
	Beaudry and Breschi (2003)	Heterogeneous results	• Knowledge stock of the cluster/region • Presence of innovative companies from the same industry
Productivity	Knoben et al. (2016)	Heterogeneous results	• Level of urbanization • Level of specialization • Level of knowledge intensity • Firm size • Level of local connectedness
	Martin et al. (2008)	Positive although weak effect	• Cluster size
Employment growth and wage level	Delgado et al. (2012)	Employment growth: positive effect	• Clustering intensity • Industry
	Ketels and Protsiv (2013)	Wage level: positive effect	• Environment • Level of specialization
Entrepreneurship, survival probability and growth of start-ups	Delgado et al. (2010)	Entrepreneurship: positive effect	• Level of specialization • Industry • Degree of innovativeness • Age of the cluster
	Wennberg and Lindqvist (2010)	Survival probability: positive effect	• Productivity level
	Wennberg and Lindqvist (2010), Stuart and Sorenson (2003)	Growth: very heterogeneous results	• Local competition • Pool of skilled workers • Age of the cluster • Cluster density
Resilience	Delgado et al. (2015)	Positive effect	• Industry • Cluster strength • Level of specialization
	Cainelli et al. (2012)	Positive effect	• Industry specialization (to a certain degree) • Urbanization economies • (Un)related variety

However, more work is necessary before the precise mechanisms of the described effects of clusters can be completely understood. In this sense, particularly the potential for adverse selection in clusters and the related question of whether "good" firms benefit relatively less from clusters than "poor" firms are very interesting areas for future scientific contributions. Furthermore, the effects that clusters exert on their surroundings, which can be very significant as, e.g., shown in the example of employment growth, have been neglected in the majority of the case studies and therefore provide a significant research gap ripe for investigation.

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Pathways of Innovation: The I-District Effect Revisited

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Abstract The I-district effect establishes the existence of dynamic efficiency in Marshallian industrial districts in the form of a positive innovative differential comparing to the average of the economy. The hypothesis has been empirically validated for the case of technological innovation using patent indicators. Empirical research has assumed that all types of patentable figures (utility models, national patents, EPO, WIPO) have the same weight regardless of its actual or expected market value, which may be questionable given the differences in coverage, protection and cost of each figure. In this article, we question the existence of the I-district effect when each patent is weighted by its expected potential value. As the I-district effect theory predicts, the relative differential effect is maintained even in the presence of the weighting, rejecting that the industrial district specializes only in low-quality patents. However, in this case, the primacy of industrial district as the most innovative local production system can be outpaced by other local production systems.

Keywords Industrial districts · I-district effect · Technological innovation · Patents

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1 Introduction

In 2001 tiles and mosaic tiles reproducing photos or designs made by computer began to appear at fairs in the ceramic industry. Their origin was due to an innovation that had appeared in the industrial district (ID) of Castellón: InkJet technology applied to tile decoration. This innovation is currently having a groundbreaking effect on the ceramic districts by replacing embossing roller technology, which was slow, relatively expensive and with limited graphical capabilities, by a cheaper, fast and flexible system (Albors and Hervas 2012), capable of printing any design in real time without interrupting the print chain. Despite its specialization in traditional sectors and small firms, the generation of technological innovation, even disruptive innovation, is not unusual in Marshallian industrial districts (IDs). Boix and Galletto (2009) coined the term "I-district effect" to describe the existence of dynamic efficiency in IDs in the form of a positive innovation differential with respect to the economy average, attributing this differential to the existence of Marshallian external economies (economies of localization). The studies that have measured the I-district effect at country level (Boix and Galletto 2009; Boix and Trullén 2010) have found favourable evidence of a strong innovative differential effect in IDs. This evidence is obtained using indicators based on patent information, which are the most commonly used indicator of technological innovation in the specialized literature (OECD 2009, p. 26). However, these papers assume that all types of patentable figures (innovation models, national patents, EPO, WIPO) have the same importance irrespective of their effective, or expected, market value, which can be arguable given the differences in coverage, protection and cost of each figure.

In this article, we question the existence of the I-district effect when each patent is assigned its expected potential value. *Would a significant I-district effect continue to exist after weighting patents based on their expected potential value?* The acceptance of a dynamic efficiency in the district (Becattini 1991; Bellandi 1992; Boix and Galletto 2009; Boix and Trullén 2010; López Estornell 2010) implies that the I-district effect should be positive and significant whether we account for the patents in homogenous way or discriminating them by value. However, even if this were true, we do not know how much the intensity of the effect will change by. The objective of the article is, therefore, to empirically contrast the presence of the I-district effect by weighting the patents by their potential value and to measure the variation of the effect. For this, an indicator has been developed that approximates the different expected commercial values of the patents.

The article is divided into six sections. After the introduction, the second section is a review of the district effect and innovation literature. Section 3 develops two models of analytical and synthetic knowledge that will serve to contrast and explain the I-district effect. Section 4 explains in detail the types of local production systems (LPSs) and the elaboration of the indicators that serve as the basis for the econometric estimation of Sect. 5. Finally, Sect. 6 offers a discussion of the results and conclusions.

2 District Effect and Technological Innovation

2.1 Industrial Districts

The ID is a new approach to economic change (Becattini 2000), starting from the fact that it cannot be understood outside a given place where the community of people and the population of firm are mutually embedded and the economic and social forces co-operate (Sforzi and Boix 2015). In this way, the relevant unit of analysis moves from the firm or sector to the place, which can empirically be approximated by a local labour market area (Sforzi 2012) also definable as a local production system (LPS).

Patterns of IDs have been identified as a generalized phenomenon in industrialized countries (Becattini et al. 2009; Boix and Trullén 2011), with them being especially significant in Italy and Spain (Sforzi 1990; Boix and Galletto 2005). In these two countries, the 2001 measurement using similar methodologies resulted in 156 and 205 IDs, respectively, accounting for 25% and 21% of total employment and 39% and 35% of manufacturing employment (ISTAT 2006; Boix and Galletto 2008).

2.2 District Effect and I-District Effect

The term "district effect" was coined by Signorini (1994) to explain the high efficiency rates of firms located in IDs. Dei Ottati (2006, p. 74) defines the district effect as the "set of competitive advantages derived from a strongly related collection of economies external to individual firms but internal to the district".

The empirical research of the district effect has been especially intense on the static effects (cost-productivity and export-comparative advantages). The main line of research seeks to quantify the differential outcome of IDs in productivity and efficiency and includes Signorini (1994), Camisón and Molina (1998), Fabiani et al. (2000), Soler (2000), Hernández and Soler (2003), Brasili and Ricci (2003), Cainelli and De Liso (2005), Becchetti et al. (2009) and Botelho and Hernández (2007). Results vary by country, sector, and type of measurement, although, in general, they provide evidence of the district effect in the form of increased productivity and increased efficiency. The district effect on competitiveness is addressed directly in Costa and Viladecans (1999), Becchetti and Rossi (2000), Gola and Mori (2000), Bronzini (2000) and Belso (2006). The aggregate results for the industry suggest the existence of a positive and significant district effect in terms of export quota, a positive but lesser effect on the likelihood of export and the existence of revealed comparative advantages. The data disaggregated by sector are not conclusive, although they suggest the existence of a district effect in more than half of the sectors.

Research on the changing component of the dynamic effect, linked to the ID's ability to innovate, has taken longer to develop. Cainelli and De Liso (2005, p. 254) argue that this fact is partly explained by the literature on IDs that considers external economies affecting the firm performance associated with low levels of innovation and partly by the difficulty of having detailed data on innovation available. The first assertion would be debatable, since members of the Florence school (Becattini 1991, 2001; Bellandi 1989, 1992) and Modena (Brusco 1975; Russo 1986) expressly emphasize the innovative capacity of the district, although it is true that other authors have continued to draw a marked bias against the district's innovative capacity as a small firm environment.

Leoncini and Lotti (2004), by means of survey data from an Italian region with a high density of IDs (Emilia-Romagna), show that ID firms have a higher probability of patenting, although the probability of carrying out research and development (R&D) activities is lower than that of firms located outside the district. Muscio (2006) also obtains evidence that the probability that the firm introduces innovation is superior for the firms located in IDs. Santarelli (2004), using data from European patents, obtains inconclusive evidence on the existence of a district effect. On the other hand, Cainelli and De Liso (2005) show that ID firms that introduce product innovations perform better than non-ID firms and that district-based product innovation firms perform better than those that innovate in processes.

Boix and Galletto (2009) investigate the differential innovative capacity of Spanish IDs with respect to the rest of the country using the number of patents per million employees. Their results prove that the IDs show a higher innovative intensity than the national average, the district innovative effect or the "I-district effect" as Boix and Galletto termed it. This behaviour is associated with the Marshallian external economies (special skilled labour, subsidiary industries, shared knowledge between firms specialized in different stages and branches of the same production process). Afterwards, Boix and Trullén (2010) disaggregated the territorial and sectoral part of the effect, concluding that the effect is more robust in the territorial dimension than in the sectorial, and therefore due to the socioeconomic organization of the district rather than its sectoral specialization. Finally, mention should be made of the work of López Estornell (2010), which asks whether the behaviour of the innovative firm is different, depending on its location in an ID of the Valencia's region, finding that the IDs specialize in a lighter and more local type of innovation with no formal protection (e.g. utility models) against a more formalized type of innovation (e.g. patents) of non-district LPS.

2.3 Innovation in IDs and the Sources of the District Effect

In the literature related to ID, it has been emphasized that the district model contributes in sustaining the innovative capacity of the firms and favours the adoption of innovations. From the theoretical point of view, there would be two explanations that could complement each other to explain the I-district effect.

First, the I-district effect would be explained by the existence of "decentralized (or diffused) industrial creativity" (Becattini 1991, 2001; Bellandi 1989). The basis of this idea is like that of the flexible integration process: if innovation can be performed in big companies and in a planned way, the innovative process could also be divisible into multiple interlinked small firms in an unplanned way, hence their denotation as "decentralized" or "diffused". Decentralized industrial creativity is reinforced by a decentralized model of absorption of new knowledge, which in turn circulates as a self-regulating output of interactions between local agents. This is a result more of search strategies and multiple interfirm co-operative interactions than of planned and deliberate efforts to carry out R&D activities as proposed in the linear model.

These interactions with their corresponding feedback take place throughout the supply chain and in all the different interfirm networks in a district, in which the firms co-operate in the manufacture of the different products, product components or stages of production. When existing knowledge is combined within a firm, new knowledge is generated which can be translated into either a simple imitation or a variant of the original innovation. Thus, marginal modifications take place through different sources: design activities, learning processes in manufacturing, interactions with customers and suppliers and reuse and re-elaboration of pre-existing external knowledge. This decentralized model of knowledge absorption conceives the innovative process as a circular process with feedback and information connections between the needs of the market and the processes of design, manufacture and search for new solutions, that is, in a cognitive spiral form in the district (Becattini 2001).

Secondly, the I-district effect can also be explained by theories of knowledge bases and differentiated modes of innovation. Rosenberg (1982) and more elaborately Jensen et al. (2007), Parrilli (2010) and Asheim and Parrilli (2012) differentiate between three types of knowledge bases, analytical, synthetic and symbolic, which are intertwined with two innovation models: STI and DUI.

The STI (science, technology and innovation) model is associated with the production of analytical knowledge that is generated in deductive and formal models of science and technology and is codified (explicit). An example is the linear model of innovation, based on science, R&D and the generation of disruptive innovations (although in practice, the bulk of the innovation generated by the model is incremental). The pharmaceutical industry is a good example of this model.

The DUI (doing, using and interacting) model, more associated with synthetic knowledge, is based on the generation of innovation through learning and problem-solving that the daily development of work raises, especially when workers face continuous changes and interact with customers, which forces them to face new problems and solve them. The search for solutions to these problems strengthens workers' skills and know-how and makes extensive use of tacit and often localized knowledge. The model of innovation DUI is oriented to the client or to the market and produces mainly incremental innovations, although in practice it is also capable of producing radical innovations. Examples of this model abound in the mechanical, ceramic or furniture industry.

The innovative process in IDs presents clear similarities to the DUI model. Thus, it entails knowledge that can be largely tacit and specialized in its context of development and application. This model recovers the importance of the experience raised in the "learning by doing" and "learning by using" models formulated by Arrow (1962) and Rosenberg (1982).

Both arguments, decentralized creativity and synthetic knowledge, are intertwined (Bellandi 1989) to such an extent that marginal modifications serve to increase demand. The existence of a broader market increases the return resulting from a greater division of labour between firms, as this specialization increases economies of scale and scope. During this process of growth, some ID firms generate new knowledge, introducing radical innovations of Schumpeterian type, that when spread around the district makes the whole district more competitive. In other words, a process is initiated that makes the district maintain its competitiveness over time. However, there are IDs that have been characterized by a growth in which continuous learning has resulted in a process of intense product differentiation, which ensures the competitiveness of their firms (Belussi 2009, p. 470). The operation of these processes causes IDs to show a positive innovative differential over other types of LPS (I-district effect) and that a priori IDs do not have to focus solely on minor technological innovation.

3 Parametric Modelling of the I-District Effect

3.1 The Analytical Knowledge Model

To model the creation of economically valuable knowledge, quantified by means of innovation indicators based on patents, the most usual way is to use a function of knowledge creation in the style of Griliches-Jaffe's functions (Griliches 1979, 1992; Jaffe 1986, 1989). In the empirical literature that employs these functions, there are explanatory variables that reflect the creation of knowledge of typically analytical type (such as an effort in R&D activities), which reflect specific characteristics of each territorial unit and indicators of the geographical proximity between agents. Regarding these indicators of proximity, let us remember that our territorial units of analysis are the LPS, which have been identified from the daily journey-to-work relationships, so that, implicitly, the geographical proximity indicator is already included. In addition, this proximity involves also an organizational proximity, answering the criticism raised about the estimates of the production function of knowledge used by administrative units as units of analysis.

The knowledge production function for a LPS j can be expressed as

$$K_j = f\left(R_j, Z_j\right) \tag{1}$$

where K_j represents the creation of knowledge in the LPS j, R_j is an indicator of the research effort carried out in the LPS j and Z_j is a vector of specific characteristics to j, which can be replaced by a combination of local indicators.

The specification of the knowledge production function is

$$K_j = \gamma R_j^{\beta} Z_j^{\delta} \varepsilon \tag{2}$$

where γ, β, and δ are parameters and ε is an error term. In the specifications of this function following Jaffe (1989), the variables are quantified in absolute terms so that a variable is included that reflects the scale (e.g. population) and, thus, considers the fact that the number of innovations may be directly related to the size of the territorial unit under study. However, for capturing the differential innovation capacity of the ID, what is relevant is to measure the relative differences, not the absolute ones, so that the input and output variables are divided by the number of employees in each territorial unit, that is, of each LPS. So, the function is

$$k_j = \gamma r_j^{\beta} Z_j^{\delta} \varepsilon \tag{3}$$

where k_j is the average innovation per worker in the LPS j, r_j is the average R&D effort per worker in the LPS j and the variables in the vector Z can also be relativized if necessary. Using logarithms, we obtain a knowledge production function transformed into a log-linear expression:

$$\log k_j = \gamma + \beta \log r_j + \delta \log Z_j + \varepsilon_j \tag{4}$$

To estimate the expression (4) for the case of the 806 LPSs identified in Spain, we consider that the innovative capacity of the LPS depends on the R&D efforts (Griliches 1979) and on factors that are specific to each LPS type, so that $\delta^{*}=f(Z_j)$. In this case, we will obtain estimators of the parameters β and of the specific parameters for each type of LPS. These parameters are considered as the measure of the differential effect on the dependent variable of each LPS type with respect to the mean of the set of observations. This interpretation is consistent with the estimation of a model of fixed effects or model of effects not observed, collecting in the δ^{*} the "individual effects" or "individual heterogeneity" of each group.

$$\log k_j = \gamma + \beta \log r_j + \delta^{*} + \varepsilon_j \tag{5}$$

3.2 *The Analytic-Synthetic Knowledge Model*

Secondly, we will approach the modelling of these fixed effects, that is, we will introduce in the model the variables related to synthetic knowledge and that in accordance with the theory also influence the local innovation capacity. This modelling will be done by introducing the vector that collects the indicators of external economies (economies of localization and urbanization) in Eq. (5), obtaining Eq. (6):

$$\log k_j = \gamma + \beta \log r_j + \delta Z_j + \delta^* + \varepsilon_j \tag{6}$$

Note that if, as the district effect hypothesis implies, δ and δ^* are correlated, the value of the coefficients and the statistical significance of δ^* will be markedly reduced, or will disappear, upon introduction of the vector of regressors Z_j.

4 Measuring Innovation in Industrial Districts

4.1 A Typology of Local Production Systems

The relevant territorial units for measuring innovation in IDs are the 806 LPS identified in Spain (Boix and Galletto 2009) through the methodology developed by Sforzi-ISTAT (ISTAT 2006; Sforzi 2009). The types of LPS are those used by Boix and Galletto (2009) and Boix and Trullén (2010), while the identification of the dominant specialization comes from the third stage of the above-mentioned methodology. Based on this methodology, seven types of LPS have been identified (Fig. 1).

First, there are three categories of manufacturing LPS totalling 332 LPSs: 205 are IDs, which account for 20.9% of total Spanish employment; 66 are LPSs of large firms (10.9% of employment); and 61 are LPSs classified neither as IDs nor as LPSs of large firms (0.8% of employment).

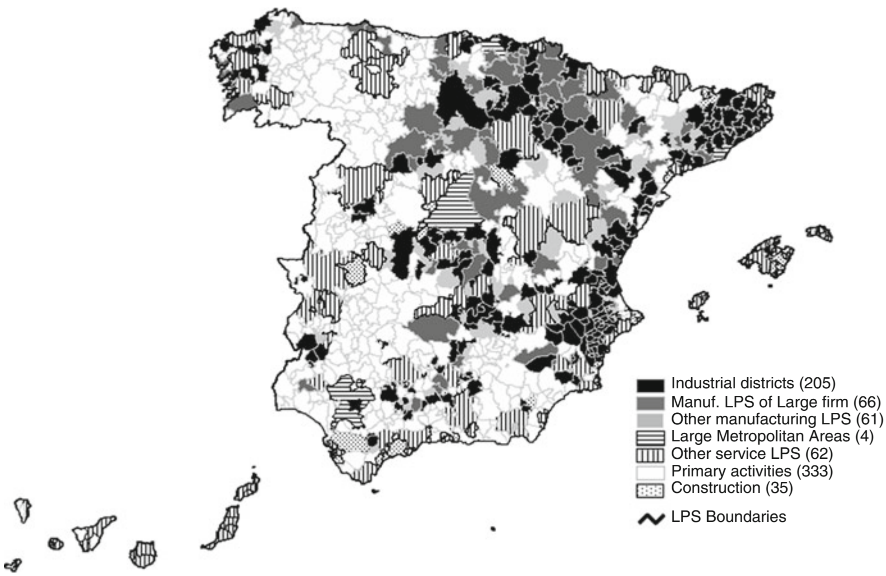

Fig. 1 Types of LPS in Spain. Source: Boix and Galletto (2009) and Boix and Trullén (2010)

Secondly, there are two categories of LPS specialized in service activities totalling 106 LPSs: 4 LPSs are specialized in business services and correspond to the central LPS of 4 (of the 5) largest Spanish metropolitan areas (28% of total employment),[1] while 102 LPSs are specialized in other services (25% of employment).

Finally, there are two remaining categories which include 333 LPSs specialized in primary agricultural and extractive activities (12.2% of total employment) and 35 LPSs specialized in construction activities (2.2% of total employment).

4.2 Measurement of Technological Innovation in LPS: The Unweighted Indicator of Innovation

The unweighted innovation indicator is elaborated following the methodology proposed by Boix and Galletto (2009). To measure local technological innovation in a comprehensive way, patent registers (national, European or world patents) and utility models (a figure of intellectual property protection that offers lower guarantees and lower application and registration costs than patents) are added to a single indicator. When a single innovation has been registered with several figures, it has been counted only once. After that the criteria to account for each type of patents have been established, we can order them according to the municipality that appears in the patent document—using the inventor address and fraction in case of more than one inventor—and elaborate the simple aggregate indicator of technological innovation by LPS.

For comparability with Boix and Galletto (2009), the technological innovation of the years 2001 to 2005 is summed. The grouping by periods is usual in innovation literature to avoid bias if only 1 year is used (Griliches 1990, 1992). However, the coverage of our patent database for the same period is almost 20% (3957 patents) higher than that of Boix and Galletto (2009). This is due to the very late appearance of records that were hidden either by administrative delays in the publication or by having exercised the right to confidentiality granted by the intellectual property law.

Table 1 shows the distribution of the unweighted local innovation indicator for the different types of LPS identified in Boix and Galletto (2009). This table also includes the distribution of employment, so that the innovative intensity can be calculated for the period 2001–2005. The most intensive innovative type of LPS is the IDs, with 446 innovations per million employees; the metropolitan areas with 427 innovations per million employees come second, followed by the manufacturing LPSs of large firms with 366 innovations per million employees.

[1]These four metropolitan areas are Madrid, Barcelona, Seville and Bilbao. The metropolitan area of Valencia is classified as an ID.

Table 1 Distribution of innovation by type of LPS: simple aggregate indicator of innovation, 2001–2005

Types of LPS	LPS		Innovation 2001–2005		Employment 2001	
	Total	%	Total	%	Total	%
Agriculture and extractive activities	333	41.3	1164	4.4	1,993,921	12.2
Manufacturing	332	41.2	11,011	41.5	5,317,479	32.6
– Industrial districts	205	25.4	7627	28.8	3,419,384	20.9
– Large firms	66	8.2	3252	12.3	1,776,129	10.9
– Other manufacturing	61	7.6	132	0.5	121,966	0.8
Construction	35	4.3	272	1.0	363,865	2.2
Services	106	13.2	14,062	53.1	8,654,448	53.0
– Metropolitan areas	4	0.5	9752	36.8	4,566,857	30.0
– Other services	102	12.7	4310	16.3	4,087,591	25.0
Total	806	100.0	26,509	100.0	16,329,713	100.0

Source: Authors' elaboration on data from OEPM, WIPO, EPO and INE 2001 Census

4.3 Elaboration of the Weighted Innovation Indicator

The expected commercial value associated with each type of patentable figure may be very different, and, therefore, adding records linearly has the risk of adding innovations of very different value. In the literature, methodologies have been proposed to deal with this problem (Guellec and van Pottelsberghe 2007, pp. 107–109), but these are complex methods, which require very complete complementary qualitative information of each patent. The large number of innovation records that we are dealing with in this research makes it impossible to follow these methods, so we propose using a method that consists of weighting patents based on the estimated average cost of obtaining a patent.

The implicit hypothesis is that who can best assess the innovative quality of a patent, understood as its potential or expected commercial value, is its applicant, who is in the best position to evaluate whether the benefit of protecting an invention outweighs the costs which are incurred when patenting. However, calculating this cost is not a simple task, since there are many parameters that determine the final cost. In this case, we will follow a very simple criterion, which consists of obtaining the costs of direct application of a patent to the corresponding office of registry of the intellectual property and indexing the cost from the most expensive of the procedures. The costs of European patents are obtained from the minimum cost calculated by Guellec and Van Pottelsberghe (2007, p. 194) for a patent designating three countries and assuming at least one translation into one of the three official languages of the European Patent Office (EPO). The resulting cost is 6370 euros. In the case of world patents (applications to the World Intellectual Property Office, WIPO), since we do not have a reference to average costs, we will use the approximation between the maximum costs (4193 euros) and minimum costs (2615 euros), according to the information we have collected from the OEPM (Spanish Office of

Table 2 Cost of the direct application for a patent to the Spanish (OEPM), worldwide (WIPO) and European (EPO) offices, in euros (2005) and quality weighting for each type of application

Cost of the direct application	Spanish utility model	Spanish patents	World patent	European patent
Cost incurred between application and being granted (euros)[a]	120	972	3404	6370
Weighting	0.02	0.15	0.53	1.00

[a]We use the 1-year rate data because differences in valuation of the invention are maintained in proportion to each year
Source: Authors' elaboration on OEPM, WIPO and EPO data

Table 3 Distribution of innovation by type of LPS: weighted aggregate innovation indicator, 2001–2005

Types of LPS	LPS Total	LPS %	Innovation 2001–2005 Total	Innovation 2001–2005 %	Employment 2001 Total	Employment 2001 %
Agriculture and extractive activities	333	41.3	176	2.0	1,993,921	12.2
Manufacturing	332	41.2	3463	39.0	5,317,479	32.6
– Industrial districts	205	25.4	2308	26.0	3,419,384	20.9
– Large firms	66	8.2	1124	12.7	1,776,129	10.9
– Other manufacturing	61	7.6	31	0.4	121,966	0.8
Construction	35	4.3	54	0.6	363,865	2.2
Services	106	13.2	5188	58.4	8,654,448	53.0
– Metropolitan areas	4	0.5	4041	45.5	4,566,857	30.0
– Other services	102	12.7	1147	12.9	4,087,591	25.0
Total	806	100.0	8882	100.0	16,329,713	100.0

Source: Authors' elaboration on OEPM, WIPO, EPO data and INE 2001 Census

Patents and Trademarks), regarding patent applications to the WIPO (that is, the cost that does not include the national phase). This average value is 3404 euros. For the Spanish patents (submitted to the OEPM), the average value between the maximum and minimum costs has also been considered in accordance with the official rates published by the OEPM, which gives a result of 972 euros. In the case of utility models, the cost of obtaining is 120 euros. In all cases these are values that were in force in the period to which the data refer.

The result is that the most expensive procedure is the European patent (6370 euros), and the costs of all figures are divided by this value to obtain the weight of each type of patent (Table 2). Next, we proceed as in the simple indicator, adding the total of patents weighted for each LPS and dividing by the number of people employed (Table 3).

The results obtained with this indicator for the period 2001–2005 show that the innovative intensity of the whole of Spain is 109 innovations per million employees, resulting from dividing the total patents among the total employment. The LPS with superior innovative capacity is now the large metropolitan areas, with 178 innovations

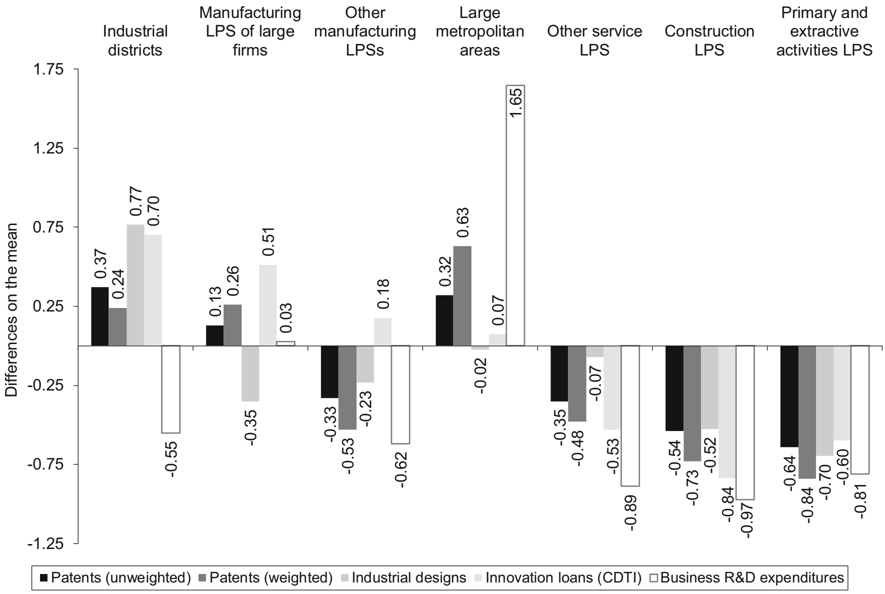

Fig. 2 Innovative capacity by type of LPS and indicator: innovations per million employees per year, with differences from the average of each indicator, 2001–2005. Source: Authors' elaboration on OEPM, EPO, WIPO, CDTI, SABI, and Census (INE) data

per million employees, ahead of the IDs that, with 135 innovations per million employees, are in second place. Third are the manufacturing LPS of large firms with 127 innovations per million employees. The other types of LPS are considerably below the mean (Table 3).

Following Boix and Galletto (2009), we compared the sensitivity of the two patent-based indicators to two other indicators whose microdata allow LPS measurement over the same time period: industrial designs from the OEPM and OHIM (now European Union Intellectual Property Office), which are indicators of innovation by output, and two input indicators: public sector grants and credits for innovation from the Centre for the Development of Industrial Technology (CDTI) and business R&D expenditures. Except for the weighted indicator and business R&D expenditures, the IDs show the most significant positive differential effect in relation to the Spanish average, and in the case of the weighted indicator, they are only surpassed by the large metropolitan areas. The results show that patent indicators are adequate for the measurement of output technological innovation in ID environments, being a more conservative option than industrial designs or CDTI credits (Fig. 2).

4.4 Elaboration of the Model Variables

4.4.1 The Dependent Variable

The dependent variable of the model is the innovation per employee in the LPS, measured by simple and weighted indicators. In both cases, for each LPS the innovations of the period 2001–2005 are added and are then divided by the number of LPS employees obtained from the 2001 Census.

4.4.2 The Explanatory Variables

The explanatory variables use data from 2001 to avoid, as far as possible, problems of simultaneity and endogeneity. Following the model presented in Sect. 3, the variables are expressed as logarithms, so that the estimated coefficients can be interpreted as elasticities. We arrange them into three groups: indicators of input to the innovative process, indicators of localization economies and indicator of urbanization economies.

(a) Indicators of input to the innovative process. The R&D expenditure of the firms is obtained from the balance sheets of SABI (Bureau van Dijk). The aggregate expenditure of the public sector and universities in R&D activities is allocated to each LPS based on the regional expenditure per person employed in R&D provided by the INE, multiplied by the number of R&D jobs in the public sector and universities in each LPS.[2] It is assumed that there is a positive relationship between R&D expenditure (public or private) and innovative capacity.

(b) Indicators of localization economies (Marshallian economies). These are grouped into five categories, which assume a positive relationship between the indicator and the generation of innovation per employee:

(b.1) Percentage of productive specialization (or non-diversity) in each LPS, calculated as a Hirschman-Herfindahl diversity index of employment E at 2-digit level of NACE sector i in each LPS j. This indicator also assumes that there is a positive relationship with the innovation indicators. Higher values of the index indicate higher specialization (less diversity) of the economic structure:

$$\mathrm{DIV}_j = \sum_j \left(E_{ij}/E_j \right)^2 \tag{7}$$

(b.2) Share of specialized industrial workers in each LPS, calculated as the percentage of manufacturing employment in each LPS. A greater share of

[2]The fact that the R&D expenditure of universities is concentrated in a few LPSs and that in the rest it is zero presents difficulties in expressing the variables in logarithms; this is the reason why we have opted to add it to the public sector expenditure.

manufacturing workers is related to greater ease of transmission of practical knowledge, either between workers in the same sector or in different industrial sectors, which facilitates their use in productive activity (through innovations). On the other hand, a greater share of industrial workers is associated with a greater availability of skilled workers for handcrafted products in the LPS and greater generation of synthetic knowledge. The relation of the capacities of this type of workers through their craftsmanship, carrying out innovation in LPSs where mass production is not dominant, has recently been highlighted in Sennett (2008) and Micelli (2011). In these LPSs, the manufacturing worker is a *maker* who has direct experience with the material world and establishes a dialogue between action and reflexivity, from which new processes and products emerge.

(b.3) Presence of suppliers in each LPS. This indicator is inspired by Dumais et al. (2002) and allows, based from the symmetric input-output table (SIOT) of the Spanish economy of the 2000, prepared by the INE,[3] to obtain an indicator of the employment in the supplier sectors of the sector i in area j (in our case, the 806 LPSs):

$$P_{ij} = \sum_{i \neq z} \vartheta_{is} \, E_{zj}, \text{with } \vartheta_{is} = v_{is} / \sum v_{is} \tag{8}$$

where v_{is} is the volume of purchases of the sector i acquired from each of the other economic sectors (calculated for all sectors of the SIOT), ϑ_{is} is the proportion of total inputs that sector i acquires from each of the other sectors and E_{zj} is the employment in each of these other activities (calculated from the 2001 Census employment data at 3-digit level of CNAE93, in order to build the sectors equivalent to those employed in the SIOT[4]).

Once the employees in each supplier activity were obtained, we added them for each LPS, obtaining a weighted total of employment. We compare this weighted sum with the actual employment total of each LPS, and this is then placed in relation to the value that is obtained from considering the whole of Spain as a single area (S_{Spain}), with which we obtain SS_j:

$$SS_j = \left(\sum_i P_{ij} / \sum_i E_{ij} \right) / S_{\text{Spain}} \tag{9}$$

If SS_j is higher than 1, the weight of employment in the supply sectors in LPS j is greater than the weight of employment in the supply sectors in the

[3]The INE only offers the symmetric tables of the years 2000 and 2005, so we used the year 2000. When using a single table for all geographic areas, it is assumed that the inter-sector supplier-customer relationships are similar between LPSs.

[4]The table of equivalences used is that published by the INE along with the SIOT.

whole of Spain. This indicator also assumes that there is a positive relationship with the innovation indicators.

(b.4) Social organization of production, using as an indicator the index of social capital developed by the IVIE (Pérez et al. 2005). This indicator is calculated for the provinces and indicates if the province has a higher, equal or lower level of social capital than the country average. Each LPS is assigned the value of its province. In the case of LPSs that cover more than one province, they are assigned the mean of the different provincial values and weighted by the percentage of employment of LPS in each province. The influence of this indicator on innovation variables is also assumed to be positive.

(b.5) Weight of employment in small- and medium-sized firms (up to 249 employees) in each LPS. This indicator aims to control which organizational model is most related to innovation capacity. It is calculated from the following expression, differentiating small firms and medium-sized firms

$$SME1_j = \sum E_{SME1,j} / \sum E_j \tag{10}$$

$$SME2_j = \sum E_{SME2,j} / \sum E_j \tag{11}$$

where $E_{SME1,j}$ is the occupation in small firms (up to 49 workers) in the LPS j and $E_{SME2,j}$ is its equivalent for medium-sized firms (from 50 to 249 workers). The relationship with innovation can be assumed positive because the agglomeration of SMEs can facilitate the processes of diffuse creativity. However, in some LPS the average firm size is so small that it could make diffused creativity difficult to operate, so that there could be a negative relationship between specialization in SMEs and innovative behaviour.

(c) Indicator of urbanization economies: indicator of physical density, the result of dividing the resident population in each LPS by the area in square kilometres of the corresponding LPS. The hypothesis that justifies the consideration of this indicator is that a higher density can facilitate the circulation of knowledge and, consequently, a greater capacity for innovation.

Table 4 presents the descriptive statistics of the dependent and independent variables.

5 Results

Following Boix and Galletto (2009) and Boix and Trullén (2010), we proceed to estimate the models sequentially. First, the analytic knowledge model (Eq. 5) is estimated for the weighted and non-weighted indicator (Table 5). The estimation is made with a fixed effects model, where the fixed effects pick up the individual effect

Table 4 Descriptive statistics: variables in levels

Variables in levels	Observations	Mean	Median	Std dev	Min	Max
Simple indicator	806	201.09	118.58	318.63	0.00	3285.22
Weighted indicator	806	47.91	9.01	129.22	0.00	1999.84
Private R&D	806	0.13	0.08	0.12	0.01	0.59
Public R&D	806	0.80	0.65	0.62	0.07	5.52
Specialization	806	2.70	2.02	2.23	1.00	13.68
Specialization in manufacturing	806	17.85	14.49	11.97	1.53	63.36
Suppliers	806	0.12	0.10	0.07	0.03	0.41
Social capital	806	1.90	2.00	0.86	1.00	3.00
SME1	806	0.80	0.86	0.23	0.01	1.00
SME2	806	0.13	0.08	0.17	0.01	1.00
Population density per km^2	806	41.18	14.22	107.66	0.95	1634.68

Source: Authors' elaboration

of each of the seven types of LPS, including the IDs. The model is estimated first for the 604 LPS that have innovation records and then for the 806 LPS using the Heckman two-step model, which allows it to control the existence of selection biases. Second, the model of analytical-synthetic knowledge is estimated, which includes the variables that explain the individual effects, that is, the localization economies (Marshallian economies) and the urbanization economies (Table 6).

The hypothesis of this article is that the I-district effect exists whether all types of utility models and patents are accounted for by the same value or they are weighted by the expected value of patents, which would mean that the ID does not specialize only in low-cost, low-quality patents. The results of the estimates clearly show that the district effect continues to be maintained by weighting patents by an indicator of their expected value and that the relative differential is not altered: in the unweighted indicator, the innovative differential of the IDs (I-district effect) is between 40% and 43% above the LPS average, like that of Boix and Galletto (2009) and Boix and Trullén (2010). In the weighted indicator, the differential is 42% higher than the mean LPS. In all cases the coefficients are statistically and economically significant. As in the previous works, localization and urbanization economies explain the differentials, reducing the coefficients of the typologies of LPS and making them statistically insignificant.

Two other relevant results emerge from the weighted indicator. First, the primacy of IDs as the most innovative LPS is now superseded by manufacturing LPS of large firms ($\beta = 0.51$) and large metropolitan areas specialized in business services ($\beta = 0.62$), although in the latter case, the coefficient is not statistically significant. This result would be expected to some extent because in these two environments the greater average size and typology of firms make the cost of European and world patents more affordable and it is also easier to exploit the potential value of these innovations. Secondly, the estimated R&D expenditure coefficients double their value with respect to the unweighted indicator, and the coefficients more clearly related to the Marshallian economies tend to be reduced and/or not to be statistically

Table 5 Estimation of the function of simple knowledge production and district effect

	Dependent variable: simple innovation indicator		Dependent variable: weighted innovation indicator	
	Fixed effects (a–d)	Fixed effects Heckman (a–e)	Fixed effects (a–d)	Fixed effects Heckman (a–e)
Constant	5.7439*	5.6995*	4.1349*	4.1370*
	(0.000)	(0.000)	(0.000)	(0.000)
Private R&D	0.2250*	0.2467*	0.4522*	0.4512*
	(0.000)	(0.000)	(0.000)	(0.000)
Public R&D	0.1838*	0.2450*	0.4728*	0.4701*
	(0.001)	(0.000)	(0.001)	(0.000)
Fixed effects				
Industrial districts	0.4016*	0.4370*	0.4213*	0.4194*
	(0.000)	(0.000)	(0.007)	(0.007)
Manufacturing LPS of large firms	0.0968	0.1356	0.5143*	0.5122*
	(0.369)	(0.209)	(0.013)	(0.015)
Other manufacturing LPS	0.3463*	0.2871*	−0.2438	−0.2395
	(0.006)	(0.024)	(0.314)	(0.335)
Large metropolitan areas	0.1215	0.1267	0.6178	0.6175
	(0.715)	(0.702)	(0.335)	(0.336)
Other LPS services	−0.2298*	−0.2005*	−0.0987	−0.0999
	(0.019)	(0.040)	(0.599)	(0.596)
Construction	−0.2884*	−0.2657	−0.2794	−0.2812
	(0.040)	(0.057)	(0.300)	(0.300)
Agriculture and extractive activities	−0.4480*	−0.5202*	−0.9315*	−0.9283*
	(0.000)	(0.000)	(0.000)	(0.000)
Fixed effects *F*-test	22.15*	23.49*	15.55*	12.80
F-test	28.04*	21.70*	36.18*	24.08
LR selection Test	9.59*	9.59*	0.00	0.00
VIF	1.04	1.19	1.04	1.19
Condition number	6.51	7.42	6.51	7.42
R^2-adj/Pseudo R^2	0.2845	0.2932	0.2674	0.2662
Log-L	−684.69	−680.48	−1080.00	−1080.00
Akaike	1387.38	1380.97	2178.00	2178.00
BIC	1427.02	1425.00	2217.63	2224
Number of observations	604	806	604	806

Notes: (a) All variables are natural logarithms; (b) P-values in parentheses; the asterisks represent statistical significance at 5%; (c) estimators of the effects *within* model; (d) fixed effects calculated under the constraint that $\Sigma\ \alpha i = 0$, so that the dummy coefficients represent deviations from the average effect of the group (intercept); (e) in case of rejecting the independence of the equations (Test LR), we compute the adjusted coefficients of Heckman

Table 6 Modelling the determinants of innovative intensity

	Dependent variable: simple innovation indicator		Dependent variable: innovation weighted innovation indicator	
	Fixed effects (a–d)	Fixed effects Heckman (a–e)	Fixed effects (a–d)	Fixed effects Heckman (a–e)
Constant	4.1714*	3.0499*	2.1329*	1.4951
	(0.000)	(0.000)	(0.003)	(0.097)
Private R&D	0.1362*	0.1499*	0.3102*	0.3180*
	(0.001)	(0.000)	(0.000)	(0.000)
Public R&D	0.1581*	0.1590*	0.3490*	0.3494*
	(0.006)	(0.005)	(0.003)	(0.003)
Specialization	0.1510*	0.1305*	0.2399	0.2283
	(0.013)	(0.029)	(0.053)	(0.067)
Specialization in manufacturing	0.5372*	0.6507*	0.4313*	0.4959*
	(0.000)	(0.000)	(0.008)	(0.004)
Suppliers	0.2934*	0.0823	0.1554	0.0353
	(0.000)	(0.272)	(0.198)	(0.823)
Social capital	0.2421*	0.2279*	0.4087*	0.4005*
	(0.001)	(0.002)	(0.008)	(0.009)
SME1	−0.1240	−0.0894	−0.1140	−0.0944
	(0.053)	(0.115)	(0.385)	(0.476)
SME2	−0.0089	−0.0001	0.3253	0.0303
	(0.740)	(0.998)	(0.648)	(0.584)
Density	0.0954*	0.1449*	0.1407*	0.1689*
	(0.001)	(0.000)	(0.015)	(0.007)
Fixed effects				
Industrial districts	0.0921	0.0755	0.1604	0.1511
	(0.327)	(0.411)	(0.405)	(0.433)
Manufacturing LPS of large firms	−0.0642	−0.0760	0.4006	0.3940
	(0.567)	(0.490)	(0.082)	(0.088)
Other manufacturing LPS	0.0714	0.0119	−0.3435	−0.3773
	(0.573)	(0.924)	(0.186)	(0.149)
Large metropolitan areas	−0.0111	−0.1130	0.2582	0.2003
	(0.972)	(0.718)	(0.691)	(0.758)
Other service LPS	0.0125	0.0865	−0.0239	0.0181
	(0.910)	(0.434)	(0.916)	(0.937)
Construction	−0.0084	0.1194	0.0042	0.0769
	(0.951)	(0.385)	(0.988)	(0.788)
Agriculture and extractive	−0.0922	−0.1044	−0.4561*	−0.4630
	(0.292)	(0.226)	(0.011)	(0.010)
Fixed effects *F*-test	0.72	1.12	2.39*	2.54
F Test	20.22*	22.95*	11.88*	10.84

(continued)

Table 6 (continued)

	Dependent variable: simple innovation indicator		Dependent variable: innovation weighted innovation indicator	
	Fixed effects (a–d)	Fixed effects Heckman (a–e)	Fixed effects (a–d)	Fixed effects Heckman (a–e)
LR selection test	12.45*	12.45*	0.49	0.49
VIF	1.51	1.90	1.51	1.91
Condition number	29.37	40.93	29.37	40.93
R^2-adj/Pseudo R^2	0.3949	0.4127	0.2965	0.2969
Log-L	−630.48	−620.98	−1064.20	−1063.48
Akaike	1292.96	1273.96	2160.41	2160.97
BIC	1363.42	1344.41	2230.86	2235.83
Number of observations	604	806	604	806

Notes: (a) All variables are natural logarithms; (b) P-values in parentheses; the asterisks represent statistical significance at 5%; (c) estimators of the effects *within* model; (d) fixed effects calculated under the constraint that $\Sigma\ \alpha i = 0$, so that the dummy coefficients represent deviations from the average effect of the group (intercept); (e) in case of rejecting the independence of the equations (Test LR), we compute the adjusted coefficients of Heckman

significant (the exception is social capital). The latter can be interpreted as a greater relationship between the use of innovation protection figures of higher expected value and innovation of an analytical type.

Finally, other indicators and complementary effects have been considered. In relation to urbanization economies, the total population of each LPS, employment density (employment over population) and physical density (population per km^2) were initially tested (separately), although they create collinearity problems. Other control variables related to human capital were also introduced, namely, educational levels, knowledge and creativity (percentage of university graduates among workers, employment in knowledge-intensive activities, percentage of people employed in ICT, in creative activities and in R&D activities), although they were economically and statistically non-significant. We also rejected the existence of significant spatial correlation between LPS in the form of lags of the endogenous or exogenous variable or in the error term.

6 Conclusions

Previous research that has addressed the I-district effect finds evidence in its favour, although they do not consider that the types of patentable records used to measure technological innovation may have different economic value.

The ID theory supports the hypothesis that the I-district effect should be maintained even if we consider different weights for patents, but it does not indicate how much it will vary. To verify this, a weighted indicator of technological innovation has been developed, adjusting the patents by their expected value, and two functions of knowledge production have been estimated econometrically, considering in the first an analytical knowledge base and in the second an analytical-synthetic base.

The conclusion is that the hypothesis of the robustness of the I-district effect cannot be rejected: the I-district effect remains economically and statistically significant and shows very similar values for the weighted and unweighted indicator (an innovative intensity of around 42% above the average of LPSs). The reason for this is that the combination of decentralized industrial creativity and DUI (doing, using and interacting) innovation generate a multitude of small innovations that integrate and consolidate into higher value innovations, both coexisting.

However, by weighting patents by the indicator used to approximate their expected value, manufacturing LPS of large firms and the centres of the large metropolitan areas show an innovative effect superior to that of the ID, as a result of the metropolitan environment and the larger size of their firms that allows them to approach larger markets, to cover the costs of international patents and to have greater expectations to obtain yields from them.

The main implication of these results is that the ID is not a weak innovator, since it does not specialize only in innovations of reduced value and is even capable of generating disruptive innovations that renew their cycles of production and reproduction. In addition, the results also show that the higher production of patents with higher expected value is also related to higher levels of private and public R&D in the LPS.

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Does Innovation Trigger the Internationalisation of Clusters?: The Case of Polish Boiler-Making Cluster

Barbara Jankowska and Marta Götz

Abstract The goal of the paper is first to synthesise the knowledge on clusters' role in internationalisation processes and second to refer to innovation as a mediating variable in the internationalisation of clusters' firms. We outline diverse channels of how clusters can foster foreign expansion, distinguishing the following types of internationalisation: *passive inward-looking* and *active outward-looking*, with *direct top-down* and *indirect bottom-up* support for the *cluster as such* and its *members*. The proposed classification may enrich the current research in this area and facilitate future studies, serving as some navigation tool and typology instrument. The case of Polish successful boiler-making cluster illustrates the consideration presented in this article. Particularly, it highlights the role of top-down, more formal activities stimulating innovation which is one of the cluster channels for promoting internationalisation.

Keywords Cluster · Innovation · Internationalisation · Small and medium enterprise (SME) · Poland

1 Introduction

Clusters are featuring high on the research agenda and are popular topic not only among scholars but also policymakers. The cluster-based policy has constituted itself as the powerful tool for regional development. The vast body of dedicated literature provides evidence of clusters advantages and their contribution to micro-, meso- and macroeconomic expansion. Pecuniary agglomeration economies, multiple externalities, favourable knowledge environment and atmosphere of trust, just to

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name the most frequently quoted, translate to firms' improved performance, regional growth and the whole economy development.

The goal of our paper is first to synthesise the knowledge about clusters' role in internationalisation processes and second to refer to innovation as a mediating variable in the internationalisation of clusters' firms. The investigation is embedded in the context of small and medium enterprises (SMEs) that usually dominate in clusters and simultaneously face huge challenges in internationalisation. They suffer from the liability of foreignness (Zaheer 1995, 2002; Johanson and Vahlne 2009) and liability of smallness (Freeman et al. 1983). Clusters might successfully cope with the challenge of the liability of smallness while trying to expand abroad developing firm-specific advantages. One of such advantages, as confirmed in many researches, might be innovation (Aharoni 1993; Wakelin 1998). Innovation emerges particularly in conducive environment, where knowledge can be easily generated and shared, where actors are ready to cooperate and exchange information and where they can trust each other and are willing to take higher risk. Innovation impacts the domestic as well as the international expansion of firms as it cannot only improve the competiveness and attractiveness of offered goods or services but also because it helps to compensate the above-mentioned liability of foreignness. The advanced, complex, knowledge-based processes, underlying any innovation, constitute a particular challenge for SMEs, which are usually inadequately equipped, underfunded and understaffed.

This chapter is structured as follows. First, we introduce the basic relations between clusters and internationalisation processes. We propose a framework which should help to navigate the discussion on this matter and facilitate the analytical exploration. We briefly describe the distinguished types of relationships. Next, we focus on one of the Polish clusters—the Pleszew boiler-making cluster. We outline the basic features of its functioning and discuss how it may contribute to outward internationalisation by its members. We conclude with some remarks on cluster role in internationalisation, stressing the aspect of firms' innovativeness.

2 Internationalisation and Clusters

Internationalisation is composed of inward as well as outward involvement in international business (Hessels 2007; Onetti et al. 2010). Internationalisation refers to the process of adapting firms' operations to the international environment (Chetty and Stangl 2009) and manifests itself in the form of international resource purchasing as well as selling in international markets (Cassiman and Golovko 2011). According to Lam and White (1999), internationalisation is a process of increasing the firms' awareness about participation in international activities. Welch and Luostarinen (1988: 36) present firm internationalisation as "the process of increasing involvement in international operations". Since clusters are often dominated by SMEs, we can state that the dominating internationalisation modes will be importing—on the inward side—and afterwards exporting as an outward internationalisation mode

(Wright et al. 2007). It happens often that importing facilitates exporting (Haller 2012) by developing a network and knowledge pools about a new market and then by creating opportunities for exporting (Holmlund et al. 2007).

Investigating the impact of clusters on cluster firms' internationalisation, we ask, on the one hand, how the features of clusters can facilitate internationalisation of cluster firms and, on the other hand, how a cluster organisation can foster the internationalisation of cluster firms. In that way, we try to account for the certain duality of a cluster. It may be, namely, regarded as a bottom-up or top-down phenomenon, spontaneously created as the initiative of local firms or a result of administrative decisions deriving from local institutions.[1] Whereas pure agglomeration economies and knowledge spillovers can refer to cluster as the natural phenomenon, supportive functions provided by various cluster organisations point to the top-down processes that can be activated.

As inferred from the proposed scheme, multiple modes of cluster-related internationalisation could be distinguished. In the next section, we very briefly discuss them, focusing later on the specific "innovation-internationalisation" channel.

2.1 Internationalisation of a Cluster as Such

The first channel we single out is the spontaneous participation in internationalisation processes of clusters as such. Cluster firms often have established brands or are registered companies with own management, executive and supervisory boards. They can be associations or limited liability firms embracing representatives of business, R&D sector and local/regional government authorities. Hence, they can themselves be actors in international relations, entering in collaboration with other similar firms. Speaking with one voice, they represent the interests of their members and lobby on behalf of them. Hence, many fully developed clusters seek more institutionalisation, which serves as a proof of an achieved maturity, reaching critical mass, and a mature level of development. Although it is popular, such institutional official dimension should rather complement the natural bottom-up processes and not precede them.

The need of cluster as such to internationalise, in order to provide necessary benefits for its members, is stressed by Islankina (2015), stating that clusters are not capable of long-term excellence and development unless their members are acting in global markets and involved in international knowledge transfer.

[1]It must be noted that classifying cluster strictly to such dimension is almost impossible, as many clusters seem to reveal features of both extreme situations.

2.2 Internationalisation of Firms: Active Outward-Looking

The second link between these two categories, cluster and internationalisation, can be the internationalisation of cluster members throughout its companies. This can be labelled as outward-looking and active internationalisation, as compared to the attracting foreign firms from outside, which stands for inward-looking internationalisation. Fostering the expansion of cluster firms abroad might happen via two channels: either indirectly via bottom-up created natural conducive environment or via top-down designed and dedicated measures aiming at stimulating foreign expansion. Hence clusters can facilitate internationalisation via providing various natural indirect advantages or by dedicated measures imposed more top-down. Additionally, this support and assistance might target export or more advanced forms, namely, foreign direct investment (FDI).

2.3 Passive Inward-Looking Internationalisation

Clusters, thanks to the provided advantages, can also contribute to internationalisation by attracting FDI. This pulling effect targeting foreign firms can be named as inward-looking passive internationalisation. Previous studies have conceptualised clusters' attractiveness for FDIs in terms of agglomeration economies, knowledge spillovers and reduced uncertainty level. These factors are regarded as important determinants for the location of multinational enterprises (MNEs). The key source of potential clusters' attractiveness for FDIs is agglomeration economies, which constitute the core of the cluster concept (spatial concentration). Another is the knowledge environment and the "tacit knowledge", in particular. Clusters are conducive for knowledge creation, diffusion and spillovers, which are an advantage from the perspective of local, home market firms and foreign companies entering the cluster as well.

3 Clusters, Innovation and Outward Internationalisation

3.1 Clusters and Innovation

The discussion on the mediating role of innovation in facilitating the outward internationalisation of cluster firms can be framed in the private-collective model of innovation (von Hippel and von Krogh 2003) and in the concept of so-called club goods (Galbraith et al. 2007). The utilisation of the private-collective model of innovation and the emergence of club goods in clusters are of great importance for SMEs. SMEs, when compared to large companies, are usually less equipped with resources, funds and skills crucial for the innovation and further internationalisation. Thus, they suffer from the liability of smallness (Brüderl and Schüssler 1990). This is an issue, especially when expanding abroad. The risk of internationalisation for firms which go abroad in comparison with indigenous firms is reflected in the concept of the liability of foreignness (Zaheer 1995). In the case of SMEs, both types of liabilities coincide, making internationalisation even more difficult. The private-collective model of innovation can result in innovations that have the characteristics of club goods, which are created thanks to partnerships for research or due to informal links with other local firms and institutions. Informal partnerships are common in clusters. Innovation can be facilitated also thanks to intra-cluster cooperation. Cohen and Levinthal (1990) highlighted that the capability to utilise external knowledge is a key antecedent of high innovation performance. Lundvall et al. (2002) argued that cooperation between a firm and its stakeholders has a positive impact on innovation capability of a firm. Cooperation with customers, suppliers, competitors and public institutions is nowadays recognised as crucial for innovation (Enkel et al. 2009). We can assume that clusters offer broad opportunities in this respect. There are studies presenting that external links and cooperation may increase the firm's innovation capability and result in high innovation output (Kaufmann and Tödtling 2001; Belderbos et al. 2004; Veugelers and Cassiman 2005). Intra-cluster cooperation in the area of innovation is the manifestation of the collaborative approach to innovation in general (Blomqvist and Levy 2006; Miles 2006; Ford and Johnsen 2001). Cooperation is directly related to the development of relationships among entities, and they represent a specific type of resources. Called as relational resources, they are reservoirs of information that can facilitate innovation and act as knowledge integration mechanism (Sobrero and Roberts 2002). Within clusters, firms create relationships with a diversified set of actors (their customers and suppliers of material, financial and non-material resources, business-support institutions, R&D organisations, local or regional government), and these relationships combine the knowledge of the actors involved. The role of collaboration with other cluster entities—still external partners from the perspective of a single cluster company—is difficult to overestimate, in particular, in the case of SMEs.

3.2 Innovation and Internationalisation

SMEs with internationalisation ambitions need innovation. Innovations provide firms with new market opportunities, contributing to the enlargement of knowledge pools, nurturing innovation. Innovation creates firm-specific advantages crucial for internationalising firms. There are studies which explore the relationship between innovation and internationalisation of firms (Alegre et al. 2012) and present innovation as the main factor facilitating entry into international markets (Becker and Egger 2007; Knight and Cavusgil 2004), crucial especially for SMEs (Cerrato 1999; D'Angelo 2010; Giovannetti et al. 2009; Nassimbeni 2001). Thus, we can assume that clusters by providing SMEs with opportunities to overcome the liability of smallness, which often hinders innovation, indirectly and simultaneously contribute to internationalisation ambitions of cluster SMEs.

The introduction of process innovation may call for importing foreign inputs (Hessels 2007); product innovation tends to foster exporting in search of a greater potential demand (Oke et al. 2007; Ruzzier et al. 2006); and the combination of product and process innovation, rather than either one of the two, increases a firm's propensity to export (Van Beveren and Vandenbussche 2010). The impact of clusters on firm internationalisation is even of greater importance for small firms. Chetty and Campbell-Hunt (2003) demonstrated how local networks contribute to the launch of new products into new foreign markets. Innovations are crucial for overcoming barriers to internationalisation.

The innovative capability of a firm can be influenced by customers' orientation (Akman and Yilmaz 2008). According to Geroski (1991), entering a foreign market can be "imitative" and "innovative". The second case means that the entry is a kind of instrument to introduce innovation. Nevertheless, the literature doesn't offer a consistent picture in terms of the impact of innovation on internationalisation. Pla-Barber and Alegre (2007) presented a positive link between export performance and technological capabilities. Monreal-Pérez, Aragón-Sánchez and Sánchez-Marín (2012) demonstrated that Spanish exporters were more likely to develop innovations and, thus, to increase their involvement in international markets than non-exporters. Van Beveren and Vandenbussche (2010) identified a positive relation between product, process innovation and export. Hashmi (2013) highlighted a negative relation with import. Becker and Egger (2007) underlined the importance of the product innovation for the decision to export. For other authors, process innovation was presented as crucial for export (Damijan et al. 2010) and import (Damijan and Kostevc 2010). However, there are works manifesting a nonsignificant effect of innovation on internationalisation (Cassiman and Martinez-Ros 2007).

Summing up, the impact of innovation on internationalisation may be ambiguous. In the next chapter, we will investigate this kind of link, embedding our considerations in the context of a boiler-making cluster in Poland.

4 The Case of the Boiler-Making Cluster in the Region of Wielkopolska in Poland

4.1 Methodology

The research uses the case study method since this method can be applied to generate or develop a theory based on empirical data. Yin (1984) indicates exploratory and explanatory case studies. The goal of the exploratory case study is to understand the context and the settings of a phenomenon (Dyer and Wilkins 1991; Guba and Lincoln 1994; Langley 1999). It allows to formulate further research questions and to establish foundations for the new theory that is why the authors define their method as the exploratory case study. According to Martínez-Fernández et al. (2012) case studies represent approximately 7% of the studies on industrial clusters. This method is often applied in the international business literature to describe and analyse processes. The exploitation of case studies and their use has been considered useful to foster the understanding of such processes (e.g. Jones and Khanna, 2006). The unit of analysis is the cluster. The data sources were the latest reports on clusters in Poland, and, in particular, the reports of Polish Agency for Enterprise Development (PARP, 2012, 2014), some materials published by the Marshal Office of the Wielkopolska Region and information available on the Internet, including published articles in the business press. The data helped to identify the key facts related to innovation and internationalisation of the boiler-making cluster and to provide a descriptive account of the intra-cluster innovation efforts was developed.

4.2 Location of the Cluster

The boiler-making cluster is located in the Southern Wielkopolska, in the Pleszew District. Wielkopolska is a region in the middle-western part of Poland with the capital city in Poznan. It is also one of the richest and most vibrant of the 16 Polish regions (voivodships, the level of NUTS 2). In 2014 Wielkopolska contributed 9.7% to the GDP of Poland, and regional GDP per capita was the third highest in Poland.

The industrial structure of the regional economy is dominated by manufacturing in terms of the number of people employed (GUS 2014: 292). The main economic actors are SMEs, with the first position belonging to micro-companies employing up to nine employees.

Looking at the R&D expenditure of firms in this region, we can observe that they unfortunately reduce this spending. The share of firms that introduced new or significantly improved products in the total number of firms in the period 2012–2014 achieved the level of 23.6% in Wielkopolska, while the same indicator for the whole country is 25.1% (GUS 2015: 485).

4.3 Cluster Core Industry and Cluster Entities

According to the Polish Classification of Activities (corresponding with the NACE Rev. 2), the core industry of this cluster is part of a bigger sector which is the manufacturing of metal structures and parts of structures. More than 10% of the whole number of firms representing this sector in Poland operates in Wielkopolska. Total number of entities focused on the manufacturing of metal structures and parts of the structures in Poland is 9577, and Wielkopolska with the Pleszew District is playing the key role with 978 firms: the third biggest spatial concentration of this sector in Poland (data obtained from GUS—Central Statistical Office in Poland 2016). However, the critical mass of producers of water boilers and complementary

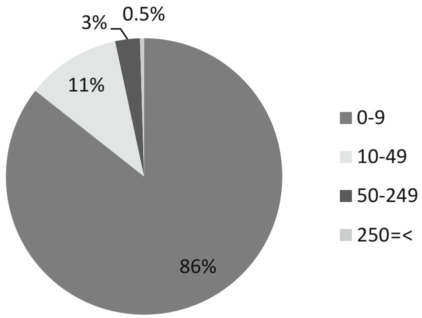


Fig. 1 The size structure (number of employees) of firms manufacturing metal structures and parts of the structures in Poland. Source: own calculation based on CSO (2016) data

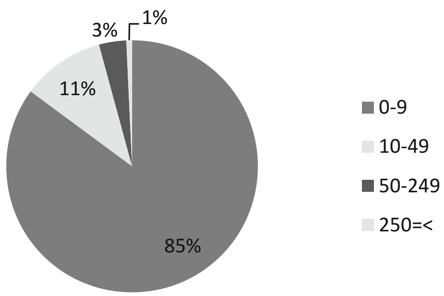


Fig. 2 The size structure (number of employees) of firms manufacturing metal structures and parts of the structures in the Wielkopolska Region. Source: own calculation based on CSO data (2016)

products is most visible in Wielkopolska since the two other locations are less specialised.

The boiler-making cluster embraces firms, R&D institutions and representatives of local and regional government concentrated in the Pleszew District. However, cluster firms cooperate with entities located in the centre of the region which is Poznan. Around 100 entities are final producers of heating boilers, and then there are components producers for heating devices, as well as electronic controllers which govern the combustion processes. These enterprises are micro and small firms. The size of boiler-making cluster companies in Wielkopolska reflects very well the structure of the whole sector in Poland (Figs. 1 and 2). Many of the cluster firms are family businesses that continue the family business tradition; thus, the firms enjoy the access to well-qualified personnel at relatively lower cost. However, they often face some constraints in terms of the capital.

The R&D sector in the cluster is represented by the Eurocenter of Innovation and Entrepreneurship affiliation in Pleszew. However, the cluster firms cooperate very actively with many institutions: the Technology University in Poznan, Poznan University of Economics and Business, Poznan University of Life Sciences, Poznan Science and Technology Park and Institute of Logistics and Warehousing in Poznan. Cluster firms cooperate via their association which can provide the services of a network broker. The network broker—in this case the cluster organisation—works as a kind of intermediary, facilitating the cooperation between business and R&D sector. The cooperation is based on letters of intent signed between the cluster organisation and R&D institutions and encompasses

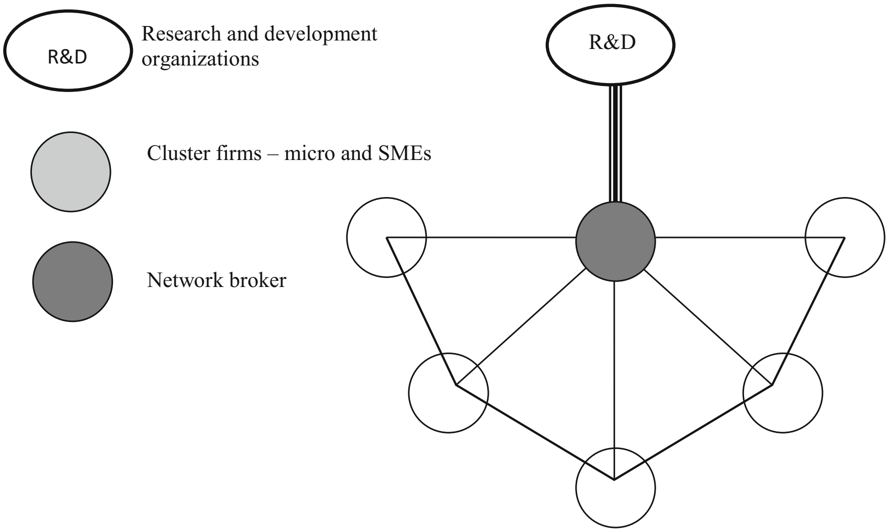


Fig. 3 Boiler-making cluster in Poland: structural characteristics. Source: own elaboration

joint seminars, workshops, study visits at firm premises, projects and consultancies. The regional government is represented by the Marshal Office of the Wielkopolska Region and the local government by the Pleszew District Office. Bearing in mind the most popular models of clusters' characteristics for particular national economies, as indicated in the literature, we can classify this cluster as a kind of mix model, bearing some Dutch and Italian characteristics (Fig. 3). The Dutch model is typical for high-tech industries, and it shows the presence of cluster institutions and universities. But at the same time, it is also similar for its structural characteristics of the business sector to the Italian type.

4.4 Intra-cluster Cooperation as the Prerequisite for Cluster Innovations

Since the cluster is dominated by micro and small firms, the building of cooperation which calls for trust and reciprocity was a big challenge. The cluster firms were in the past characterised by high level of mistrust. These enterprises, being quite similar in terms of size and capabilities, were quite reluctant to cooperate. That is why to foster this process the Marshal Office of the Wielkopolska Region decided to start a cluster initiative, in order to facilitate the value-adding cooperation among spatially concentrated manufacturers of boilers and complementary products in the Pleszew District. The notion of cluster initiatives was defined by prominent experts in the field of clustering—Sölvell, Lindquist and Ketels (2013: 1)—"Cluster initiatives are organized efforts to increase the growth and competitiveness of clusters within a region, involving cluster firms, government and/or the research community". In the case of the boiler-making cluster, the cluster initiative was the foundation for the establishment of a cluster organisation. In Poland cluster organisations with legal personality can operate as associations, foundations, limited liability companies or cooperatives. A truly operating cluster organisation becomes a transparent platform for cooperation, and further its activities help to reduce information asymmetry as well as to decrease the potential of opportunistic behaviours. In the case of this cluster, the cluster organisation got the form of an association. A cluster organisation is a tangible manifestation of cooperation between cluster members, though it usually does not include all the cluster firms. The positive impact of cluster organisations on the intensity of intra-cluster cooperation happens only if there is a truly operating cluster, where the critical mass of entities is big enough. These firms are, on the one hand, eager to develop cooperation, but, on the other hand, afraid of revealing their core competences. Before formally joining their forces, the cluster firms offered relatively similar products in the market—boilers. Since the innovativeness of these boilers was not very high, their producers were focused on the national market which made the rivalry even more fierce. Hence, once the cluster initiative has been launched, cluster firms were usually positive about the perspective of enhanced cooperation with their suppliers and customers, but not that positive about cooperation with their competitors. To overcome the reluctance to intra-cluster cooperation among competitors, the cluster organisation and the cluster manager, in particular, decided to develop a cluster official web page where each cluster firm that formally joined the organisation is presented. But each time, when one refreshes the page, the display order of the cluster firms changes. In this way, the firms perceive they are equally important.

The facilitation of intra-cluster cooperation was the prerequisite for triggering intense and substantial innovation efforts of cluster firms. The establishment of the cluster organisation for boiler makers was justified by the fact that firms were micro and small entities, suffering from the liability of smallness. They didn't have enough resources, and as micro or small enterprises, they didn't have a big bargaining power towards R&D institutions. That is why 30 out of the 100 cluster firms decided to develop a sub-group within the cluster, called Innovative Pleszew Boiler. This sub-group generated a huge progress in terms of innovation, and nowadays the boiler-making cluster offers a cluster product that is sold under the brand of the cluster. The next step was the establishment of strong cooperation of cluster firms, focused on the identification of new solutions in terms of the fuel used for the boilers, and subsequently a new innovative boiler was developed. This sub-group of firms uses the name of advanced technologies.

To increase the sustainability of innovation efforts, the cluster firms agreed to create the "library of good practices", which is a set of six notebooks synthesising the knowledge of entrepreneurs in the field of construction, design, certification, logistics and management. This is a valuable asset of the cluster which deserves the notion of a "club good".

The innovation efforts of boiler makers were supported very much by the cluster manager. He was the key agent encouraging firms to collaborate, explaining the benefits to these micro firms and SMEs of complementing competition with cooperation. The cluster organisation obtained public funding by the European Union Funds—within the Human Capital Operational Program.

4.5 Innovation as the Trigger of Internationalisation

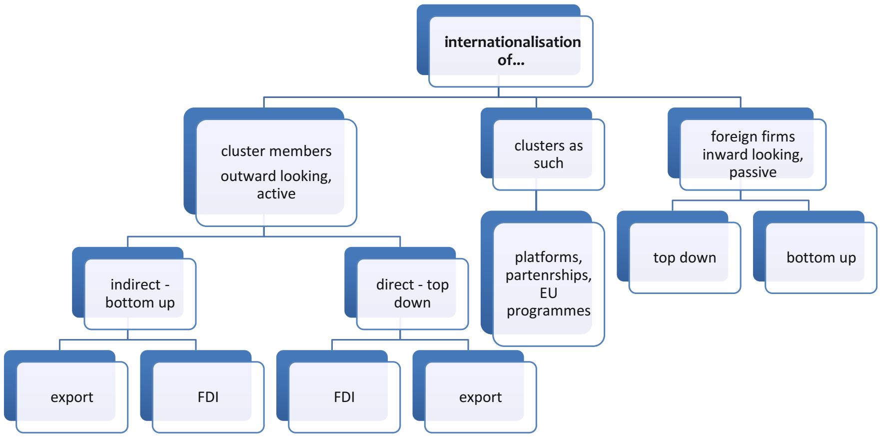
Joining forces under the heading of Innovative Pleszew Boiler allowed the firms to efficiently organise the development of a new product and division of tasks which reflected firms' specialisation. It was the first very visible manifestation of value-adding cooperation among cluster firms. Earlier, before the participation in the cluster initiative, the firms produced boilers, too. But these products were not recognisable abroad and not innovative enough to win in foreign markets.

To successfully launch the product into the global market, the cluster firms needed a trademark. That is why they developed together the trademark and applied for the protection of this trademark which they finally obtained in the form of protection certificate. The protection certificate is a document confirming that a particular firm has the right to use this trademark, and it is the legal owner of it. Before getting the certificate, this particular trademark was checked by the Patent Office in Poland. The outcome of this checking was positive, and cluster firms got the certificate. Additionally, the boiler-making cluster applied for the patent protection for the design and construction of this innovative boiler. Formally this innovative product belongs to the association of the cluster firms, but since the 30 firms entered into the licence agreement, they can manufacture the product and its parts. Licensing strengthens their cooperation. The design and construction allow combining different big parts of similar products which is positive from the perspective of cooperating firms.

The construction of this boiler is so innovative that cluster firms can compete in international markets and in the neighbouring European markets. This is the manifestation of the active, outward-looking internationalisation of cluster entities (Scheme 1). A few of cluster enterprises manage to lure foreign clients. Thirty firms were involved in the Innovative Pleszew Boiler Association, which is monitoring product quality, making efforts to increase the trust of clients towards this product.

The development of this innovative product triggered the internationalisation of the cluster firms. At the beginning, it was just the participation in international fairs. Then a few export contracts were signed. The common cluster trademark allows cluster firms to better position their offer, being noticed by potential clients during the fairs, since they can afford bigger stands. This was a mode of active outward-looking internationalisation that emerged at the level of the whole cluster organisation. Thus, it reflects the internationalisation of a cluster as such (see Scheme 1). The firms' legitimacy increased substantially.

There are multiple risks which can materialise and endanger the collaboration of cluster members such as the break-up of joint agreements, the violation of contracts



Scheme 1 Framework organising the research on clusters and internationalisation. Source: own proposal based on Jankowska (2013) and Jankowska and Götz (2016)

and gentlemen agreements, the growing of the outside pressure, increasing uncertainty, mistrust, etc. In the boiler-making cluster, it was the manager who initiated the formalisation of the cluster and developed actions accelerating cluster growth. Cluster organisations must therefore constantly be observed, and monitored, as nothing can be taken for granted.

5 Conclusions

Internationalisation is recognised as the process of developing links with foreign firms—in this sense it is related to the foreign expansion of the cluster (active, outward-oriented internationalisation) and expansion of foreign firms into the cluster (passive, inward-oriented internationalisation). Our review highlights the multichannel impact on clusters' internationalisation.

In the first part, we discussed the theoretical model, building a rough basic typology. We believe that our systemic short review and forwarded classification might contribute to organising future studies.

In the second, we presented the case study of a successful boiler-making cluster in the region of Wielkopolska. Its features, particularly the formal assistance and stimulation of innovativeness, seem to be the main contributing factor to cluster's internationalisation. Hence, by highlighting the innovations and the top-down assistance of a cluster organisation, we have illustrated one of the distinguished roles of local institutions promoting the internationalisation process (Halilem et al. 2012; Chetty and Stangl 2009). The evidence of the impact of public policies is mixed (Holmlund et al. 2007; Korhonen et al. 1996). There are studies that have demonstrated that SMEs that received public support were more likely to engage in product and process innovation (Roper et al. 2008), while others found nonsignificant results for the effect of government supports on firms innovation activity (Nauwelaerts and Vijfeyken 2013). The case of the boiler-making cluster manifests the positive role played by the cluster organisation and by the top-down approach to clusters. Nevertheless, the prerequisite for efficient and effective actions by clusters organisations is the existence of a truly operating cluster environment.

Considering innovativeness and SMEs' internationalisation (Cassiman and Golovko 2011), firms' size has always been mentioned as a crucial factor. Some researchers claimed that size is not significant for distinguishing innovation performance (Camisón and Villar-López 2012) and export performance (Blomstermo et al. 2004); others argued that it is significant and positive for both (Roper et al. 2008; Stoian et al. 2011). In the case of boiler-making cluster, small size was not an obstacle for innovation and for internationalisation.

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Inward FDI and Skilled Labour Force in Veneto Industrial Districts

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Abstract Technological changes, globalisation and the increasing heterogeneity of firms populating Italian industrial districts (IDs) have deeply affected the fabric of these IDs. This chapter sheds light on the contribution of inward foreign direct investments (FDIs) to the host country's skilled workforce, which is one of the most critical factors in IDs' socio-economic resources. The chapter investigates whether, within the IDs, the labour workforce skills composition of affiliates of foreign multinational enterprises (MNEs) differs from that of uni-national firms. The analysis uses microdata from the Veneto NUTS-II region (Northeast Italy), as this is an economic area world-renowned for its manufacturing production and has historically been considered as a referential context for the Italian ID model. The results show that foreign affiliates of MNEs located in the Veneto IDs hire more skilled workers and more experienced workers (above 30 years old), as well as fewer foreign workers. This provides evidence of a positive impact of the presence of foreign affiliates of MNEs on the sustainability of IDs' socio-economic fabric.

Keywords Industrial district · Skills composition · Propensity score matching · Industrial commons · Inward FDIs

1 Introduction

The talents present in particular regions define their economic value as never before. A specialised, skilled workforce is a key economic development asset that enhances local and regional innovation capabilities (Jacobs and Hawley 2009; Capello and Lenzi 2015). According to Pisano and Shih (2012: 23), there is a close connection

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between the competitiveness of companies and the competitiveness of workers located in the same area. If workers are not endowed with appropriate skills (education and training), then the enterprise's competitive power will be threatened. Conversely, dense concentrations of highly skilled workers in geographically localised clusters trigger virtuous processes of economic growth (Moretti 2012). The external economies of localisation, or "industrial commons" (Pisano and Shih 2009, 2012), comprise: skilled workforce, supply networks, manufacturing culture and social capital, which are necessary to support manufacturing.

In this context, it is crucial to investigate how companies located in developed countries employ their local labour forces, and how this use fosters skilled workers' upgrading (Barzotto et al. 2016b). Specifically, issues that have been neglected by the literature include the role played by foreign MNEs (henceforth FMNEs) in sustaining local human resources present in industrial districts (IDs). MNEs are often considered to be key actors that influence local, regional and national performance in terms of learning, innovation, competitiveness, growth and development (see, among others, Cantwell and Mudambi 2005). The embeddedness of MNEs, in terms of both their location and their networking strategies, has therefore become a crucial goal of local and regional development policy (Zanfei 2000; McCann and Mudambi 2005). In particular, IDs, which are characterised by an industrial atmosphere of collective information and knowledge specific to the business (Becattini 1990), may allow MNEs to benefit from agglomeration economies relating to collective learning, labour market pooling and local buzz (Mariotti et al. 2014).

This chapter focuses on IDs in the Veneto NUTS-II region (Northeast Italy) and analyses whether and how the affiliates of FMNEs in 2014 contributed to improving the IDs' socio-economic fabric and specifically to fostering local, experienced, highly skilled workers within the IDs. The Veneto region was chosen because it has traditionally been a world-renowned economic area for manufacturing production based on IDs in the "Made-in-Italy" sectors. In 2011, it hosted 19.9% (28) of Italian IDs and employed 26.7% of total workers. The region attracts significant inward foreign direct investments (IFDIs)—four times higher than the Italian average and five times higher than the Lombardy region which is considered to be Italy's economic and financial hub.

To address the issue empirically, a novel database was adopted, merging economic data on manufacturing FMNEs and on uni-national firms (UNINATs) in Veneto in 2014.[1] Specifically, the firm-level dataset combined three sources of data:

1. The Reprint database, which records inward and outward manufacturing FDIs in Italy since 1986 (Mariotti and Mutinelli 2016)
2. The AIDA database by Bureau van Dijk, which provides balance sheet data on active Italian firms
3. The Informative System Veneto Labour (SILV) dataset by Veneto Lavoro, which registers the employment composition of firms active in Veneto

[1] Uni-national firms are those firms that have never undertaken FDI abroad nor been acquired by foreign MNEs.

Matching the three datasets based on firms' fiscal codes allowed the employment structures of two typologies of firms to be compared. ID classifications, provided by the Italian Statistical Institute (ISTAT), allowed us to distinguish between district firms and non-district firms. Descriptive statistics and econometric analysis were developed, devoting particular attention to firms' labour composition (in terms of skills level, age and nationality), performance and location inside or outside an ID.

The chapter is structured in five sections. Section 2 reviews the literature on (a) firm heterogeneity by ownership (Sect. 2.1), (b) host-country effects of IFDIs (Sect. 2.2), (c) MNEs' location determinants and agglomeration advantages (Sect. 2.3) and (d) the contribution of IFDIs to local industrial commons (Sect. 2.4). Section 3 focuses on the data and methodology. Descriptive statistics and econometric analysis are given in Sect. 4, and Sect. 5 draws some conclusions.

2 Literature Review

This chapter focuses on the effects of IFDIs on the host country's labour composition and investigates differences in the proportion of local, experienced, highly skilled labour in UNINATs and FMNEs located in Veneto's IDs in 2014. This analysis allows us to shed some light on the contribution of IFDIs to the IDs' industrial commons. Four strands of literature are involved in this reasoning: (a) firm heterogeneity by ownership; (b) the host-country effects of IFDIs, specifically on the host country's labour market; (c) MNEs' location determinants and agglomeration advantages and (d) the contribution of IFDIs to IDs' industrial commons. According to Pisano and Shih (2009: 13), the latter consist of "technological know-how, operational capabilities and specialised skills that are embedded in the workforce, competitors, suppliers, customers, cooperative R&D ventures and universities and often support multiple industrial sectors".

2.1 Firm Heterogeneity by Ownership

Firms are heterogeneous in terms of efficiency and competitive capabilities. Firm heterogeneity has been widely debated in the empirical literature (Barbosa and Louri 2005; Castellani and Zanfei 2006; Greenaway and Kneller 2007; Mayer and Ottaviano 2007; Brouwer and Mariotti 2014), and one stream of studies focuses on heterogeneity linked to ownership. Firms in international markets are more likely than firms in smaller domestic markets to adopt new technologies and achieve higher productivity (Schmitz 2005). They may generate knowledge spillovers through various intra- and inter-industry interaction mechanisms (Mariotti et al. 2008; Beugelsdijk et al. 2010; Ietto-Gillies 2012; Iammarino and McCann 2013), and they may affect domestic productivity through competition, imitation and training (Dunning 1993).

However, empirical studies have focused mainly on comparing FMNEs and domestic firms in terms of labour productivity, capital intensity, firm size and wage levels, while little attention has been devoted to labour composition, which is crucial to enhancing a territory's competitiveness. One recent study does focus on this issue (Barzotto et al. 2016b), finding that UNINATs and FMNEs located in the Veneto region between 2007 and 2013 differed in terms of workforce skills composition, in that affiliates of foreign MNEs tended to employ a larger proportion of highly skilled labour.

2.2 Effects of IFDIs on a Host Country's Labour Market

The main effects of IFDIs on the host country are on wages, employment and skills, productivity and knowledge spillovers to domestic firms, exports and the introduction of new industries and host-country growth (see Lipsey 2002; Ietto-Gillies 2012; Barba Navaretti and Venables 2004).

The literature clearly shows that foreign-owned firms pay higher wages than domestically owned firms because they tend to be in higher-wage sectors of the economy and are larger; more capital-intensive; more innovative with respect to products, production processes and production organisation; and more intensive in their use of intermediate products (Doms and Jensen 1998; Barbosa and Louri 2005; Ietto-Gillies 2012; Castellani and Zanfei 2006; Greenaway and Kneller 2007; Mayer and Ottaviano 2007). FMNEs tend to hire more educated and better qualified workers (Girma and Gorg 2007) and to invest in staff training courses and better working conditions (OECD 2008; Driffield and Taylor 2002). Another reason why FMNEs pay employees more than their counterparts relates to the need to overcome information asymmetry (Barba Navaretti and Venables 2004), since they own less information than local firms in the institutional and productive context in which they offshore.

As far as productivity is concerned, foreign-owned firms have higher productivity levels (Griffith and Simpson 2001; De Backer and Sleuwaegen 2002; Castellani and Zanfei 2006), mainly because of larger-scale production in foreign-owned plants (Lipsey 2002). Moreover, some studies find positive productivity spillovers towards domestically owned firms, while others see the evidence as inconclusive. IFDIs are responsible for the introduction of new industries or products to the host-country economy and tighter linking of the host country to the world trading system (Lipsey 2002). Therefore, both the productivity effects of IFDIs and the development of new (to the host country) products impact on the host country's economic growth, albeit sometimes negatively (e.g. fast growth may involve disruption and destruction of the value of old production techniques and old skills).

2.3 MNE Location

The literature on FDI determinants indicates that MNEs spread their investments between countries to maximise their risk-adjusted profits (Caves 1974). These profits may depend on three groups of factors in the eclectic OLI paradigm developed by Dunning (1979, 1993, 2003, 2009). "**O**wnership advantages" are firm-specific factors enabling the firm to grow more successfully than competitors in the home or host country (e.g. proprietary technology and management expertise). "**L**ocation advantages" are location-specific factors in the host country that make it the best place for the firm to do business (e.g. cheap labour, growing market size and good infrastructure). Finally, "**I**nternalisation advantages" are factors associated with the firm's trade-off between FDIs and exporting or licensing (e.g. trade barriers and difficulties in finding a trustworthy licensee). The main location determinants identified by both location theory and research on location advantages are (1) "traditional" location factors (labour costs and availability, labour skills and labour unionisation, market size and market potential, competitiveness level and density, land costs and availability, agglomeration economies, transportation costs and other costs, taxes and financing); (2) infrastructure, services and intangible assets; (3) environmental and social context; (4) policy framework; and (5) information costs (see Appendix, Table 8).

Scholars suggest that localisation externalities are linked to increasing returns and better innovation (see the Arrow-Marshall-Romer model in Glaeser et al. 1992). Localisation externalities allow geographically concentrated firms in the same industry to learn from each other, exchange ideas and access external knowledge and resources without monetary transactions (e.g. Brusco 1982; Piore and Sabel 1984; Saxenian 1994). This fosters knowledge spillovers between firms and facilitates innovation within that particular industry in that location.

The literature emphasises that international firms may benefit from being located in certain agglomerations. MNEs have a great deal to gain from locating in IDs because it is generally advantageous to locate their facilities where other similar establishments are concentrated (Andersson et al. 2002; Bronzini 2007).[2] Specifically, location in an ID provides access to a trio of key agglomeration economies—a local pool of skilled labour, local input-output linkages and local spillovers (Marshall 1890)—and therefore to industry-specific knowledge and skills (Mariotti et al. 2014). Evidence from Italian IDs confirms that MNEs' strategy of acquiring district firms enables them to become deeply immersed in the industrial atmosphere of the district, to catch novelties and market changes and to grasp contextual knowledge produced locally (e.g. Belussi and Asheim 2010). According to Iammarino and McCann (2013: 203), "following a combination of Marshall, Vernon, Porter and Alchian's arguments, 'knowledge-intensive' MNE operations should be located in 'knowledge-

[2]According to Becattini (1990: 40), "Industrial districts are geographically defined productive systems, and in various ways, [involved] in the production of a homogeneous product, with different specialisations but interconnected with each other".

intensive' regions characterised by other similar knowledge-intensive activities and establishments".

2.4 Contribution of IFDIs to Local Industrial Commons

In the last two decades, offshoring and technological changes have impacted on IDs. District firms—mainly medium-sized and large ones—belonging to global networks have generated external economies that go beyond cluster boundaries. The strong industry specialisation originally peculiar to district areas is fading, but the necessary manufacturing supply infrastructure and know-how embedded in firms, as well as the education system and public institutions, can still be found in these areas. Within this novel ID phenomenon, "industrial commons" seems a more appropriate description of the resources currently present in district areas (Barzotto et al. 2017). As previously mentioned, Pisano and Shih (2009, 2012) define industrial commons as "the set of manufacturing and technical capabilities that support innovation across a broad range of industries" (2009: xii). Industrial commons can be classified as goods whose use is difficult to exclude from potential beneficiaries. These goods are also characterised by a certain level of rivalry, especially when allocations of these resources fall below a critical threshold.[3] Knowledge flowing through companies constantly nourishes the commons, through movements of employees, supplier-customer collaborations and formal and informal technology sharing.

As described in the literature on the effects of FDIs on host countries, foreign MNEs may trigger new dynamics in IDs (De Marchi et al. 2014; De Marchi and Grandinetti 2014). Indeed, MNEs play a crucial role in diffusing knowledge both within and outside ID boundaries (Hervas-Oliver and Boix-Domenech 2013; Sedita et al. 2013). For example, Morrison (2008: 818) finds that MNEs, as leading firms, make significant efforts to search for and translate knowledge from external sources, including universities and sectoral research centres. Barzotto et al.'s (2017) recent investigation of how MNEs can boost the regeneration of industrial commons in a district area identifies five local assets that are crucial for sustaining the development of an ID and hence the innovation capabilities of companies populating that area: (1) labour pools and distinctive skills; (2) supplier and user networks; (3) education and research systems (including universities, lifelong education and public and private research centres); (4) public, private and associative institutions; and (5) the financial system and its ability to provide companies with capital and information. The authors find that MNEs can sustain the regeneration of IDs' production fabric by

[3]As industrial commons are a positive externality, two important aspects can be identified: (i) the existence of a social benefit arising from the fact that the company can draw on the assets of the local commons without payment and (ii) the absence of property rights, which may easily give rise to a market equilibrium lower than the social optimum. Depending on the types of local resource, the imbalance arising from their under-/over-exploitation may lead to the rapid disappearance of goods (Barzotto et al., 2016a).

recombining the specificities of geographically close IDs, which in turn leads to the creation of new products and/or the development of new sectors. The capability of MNEs to exploit and recombine industrial commons enables them first, to penetrate international markets; second, to nourish a critical mass of talented labour, educational and research centres and specialist firms; and third, to ensure the regeneration of ID capabilities, as well as the flourishing of specific industries.

3 Data and Methodology

The latest classification of Italian IDs is provided by ISTAT's ninth census of industry and services (ISTAT 2015), which identifies 141 IDs specialising in 11 macro-sectors. IDs represent about a quarter of the Italian productive system in terms of local labour systems, jobs and local units; and IDs' manufacturing employment represents more than a third of total Italian employment.

Table 1 shows the distribution of the 141 IDs by geographical area. As already stated, the Northeast macro-area, which represents the traditional reference area of the Italian ID model, hosts the majority (45; 31.9%), with Veneto accounting for 28 IDs (19.9% of Italian IDs) and 26.2% of total employees (Table 1). Veneto and the Lombardy region host about 40% of Italian IDs (19.9% and 20.6%, respectively) and 60% of the district's manufacturing employment (26.2% in Veneto and 33.7% in Lombardy).

Among the 141 IDs, 130 (92.2% of the total) specialise in Made-in-Italy sectors, with a prevalence in machinery and equipment (27%), textiles and clothing (22.7%), wood and furniture (17%) and leather and footwear (12.1%). In terms of geographical distribution, area specialisations do emerge: the Northwest reveals an above-average number of districts specialising in metal products, machinery and equipment and textiles and clothing and the Northeast in wood and furniture, machinery and equipment and jewellery. Districts specialising in leather and footwear prevail in the Centre and the South, while those specialising in food and beverages dominate in the South (Table 2). Veneto registers the highest percentage of IDs in machinery and equipment (31.6%) and wood and furniture (29.2%). It also hosts a quarter of Italian IDs in jewellery, 11.8% of leather and footwear districts and 15.6% of textiles and clothing districts (Table 2).

Data on the affiliates of FMNEs (IFDIs) located in Veneto's IDs were drawn from the Reprint database, compiled by the Politecnico di Milano and sponsored by the Italian Institute for International Trade (ICE). This dataset provides an annually updated census of both foreign affiliates of Italian firms and Italian affiliates of foreign firms (in terms of numbers of employees and sales) since 1986 (for details, see Mariotti and Mutinelli 2016). According to Reprint, 257 FMNEs invested in Veneto in 2013, with 299 manufacturing affiliates representing 11 per cent of total foreign affiliates in Italy (Table 3).

In addition to the Reprint dataset, two other datasets were used: the AIDA database by Bureau van Dijk, which provided data on the balance sheets of

Table 1 Geographical distribution of Italian industrial districts in 2011

	Industrial districts		Employees	
	n	%	*n*	%
Northwest	37	26.2	1,812,392	37.1
Northeast	45	31.9	1,788,770	36.6
Veneto	28	19.9	1,278,439	26.2
Centre	38	27.0	959,537	19.6
South and islands	21	14.9	326,828	6.7
Italy	141	100.0	4,887,527	100.0

Source: Authors' elaboration of ISTAT data

Table 2 Sectoral and geographical distribution (%) of Italian industrial districts specialising in Made-in-Italy sectors in 2011

	Northwest	Northeast	Centre	South and islands	Italy	*Veneto*
Wood and furniture	8.3	54.1	33.4	4.2	100.0	29.2
Jewellery	25.0	25.0	50.0	0.0	100.0	25.0
Machinery and equipment	44.7	50	5.2	0	100.0	31.6
Metallurgy	75.0	25.0	0.0	0.0	100.0	0.0
Food and beverages	13.3	20.0	13.3	53.2	100.0	6.7
Leather and footwear	5.9	11.8	70.6	11.8	100.0	11.8
Textiles and clothing	21.9	18.7	31.3	28.2	100.0	15.6
Other industries	57.1	0.0	14.3	28.6	100.0	0.0
Total	26.2	31.9	27.0	14.9	100.0	19.9

Source: Authors' elaboration of ISTAT data

Table 3 Inward FDIs in Italy and Veneto in 2013—manufacturing industry

	Inward FDIs in Italy (total)	Inward FDIs in Italy (control)	Inward FDIs in Veneto (total)[a]	Inward FDIs in Veneto (control)[b]
Investing MNEs	1673	1552	257 (15.4%)	226 (14.6%)
Affiliates of MNEs	2723	2425	299 (11%)	258 (10.6%)
Employees—affiliates	484,784	430,676	35,053 (7.2%)	30,134 (7%)
Foreign affiliates' turnover (million Euros)	211,484	180,003	10,815 (5.1%)	8956 (5%)

Notes: [a]Total inward FDIs; [b]Only control inward FDIs. Source: Reprint data manufacturing firms located in Veneto during the period 2007 to 2013, and the SILV database by Veneto Lavoro, which registered the employment composition (age, gender, citizenship, professional activity, educational qualifications, type of contract, new hirings/dismissals) of firms active in Veneto in 2014. Matching these datasets allowed us to compare the employment structures of FMNEs and UNINATs located in 1 of the 28 Veneto IDs.

After cleaning up the dataset, the sample of FMNEs and UNINATs consisted of 6953 district firms, of which 131 were FMNEs and 6822 UNINATs (firms that had neither been acquired by foreign companies nor invested abroad throughout the period 2007–2014). FMNEs and UNINATs located in Veneto's IDs were compared through descriptive statistics and counterfactual analysis. The descriptive statistics explored whether and how FMNEs and UNINATs differed according to sector specialisation, size (turnover), labour costs and employment composition in terms of skills, age and nationality (Table 4). The results of the descriptive statistics were corroborated by counterfactual analysis with reference to the last year of the period of analysis (2013 for firm characteristics, and 2014 for labour composition data).

The counterfactual analysis was run in order to construct an appropriate counterfactual group of UNINAT firms to compare with the FMNEs. The crucial assumption behind matching the two groups of firms (treated: FMNEs; untreated: UNINATs) was that, conditional on a set of observable characteristics (X), the potential outcomes (Σyi) were independent of the outcome. When selecting cases on this assumption, the counterfactual outcome of cases in group A (FMNEs) should be the average outcome of group B (NATs), with the same selected observable characteristics (Caliendo 2008). In order to construct an appropriate counterfactual, propensity score (p-score) matching was adopted, consisting of a discrete choice model and an ATT (average treatment on the treated). First, a logit model was estimated, where the dichotomy—assuming a value of 1 if the company had a foreign participation—was regressed on the size proxy and on sector dummy variables (Pavitt's sector classifi-

Table 4 Variables and data sources

Label	Variable	Unit	Year	Source
Firm characteristics	Ownership	Dummy variable	2007–2013	Reprint
	Macro-sector	Dummy variable	2007–2013	AIDA
	Firm size (turnover)	Thousands of Euros	2007–2013	AIDA
Performance	Labour cost per employee	Thousands of Euros	2007–2013	AIDA
Labour composition	Share of highly skilled workers	No. of workers/share	2008, 2014	SILV
	Share of under 30 workers	No. of workers/share	2008, 2014	SILV
	Share of foreign workers	No. of workers/share	2008, 2014	SILV

cation of manufacturing industries).[4] Turnover referred to 2010 in order to control for the FMNE cherry-picking argument that "the best performing local firms are taken over by foreign investors" (e.g. Criscuolo and Martin 2004; Crinò and Onida 2007; Crinò 2010). An ATT was developed in STATA14, using the five nearest neighbours matching method (random draw version) with replacement and caliper (= 0.01) and conditioning on common support (see Caliendo and Kopeinig 2008). The new sample resulting from the p-score matching (counterfactual analysis) was composed of 86 FMNEs and 4856 NATs. Sample validity was checked through econometric tests to evaluate the absence of statistically significant differences between the two groups of companies along the dimensions used to create the counterfactual sample.

4 Empirical analysis

4.1 Descriptive Statistics

As previously stated, the database on UNINATs and FMNEs located in Veneto's IDs recorded 6953 observations, of which 6822 were UNINATs and 131 FMNEs. Analysis of the specialisation sector was based on classifications in three macro-sectors, according to Pavitt's classification:

- Direct Made-in-Italy (e.g. textiles, footwear and leather), characterised by innovation provided mainly by suppliers, and the majority of their technology provided by other sectors
- Indirect Made-in-Italy (e.g. machinery and equipment), dependent on specialist-suppliers with engineering knowledge and competencies
- Other sectors (e.g. pharmaceuticals and electronics), mainly scale-intensive and science-based, with insourced R&D

With regard to sector specialisation, the two groups of firms operated mainly in the Direct Made-in-Italy sector (47% of UNINATs and 53% of FMNEs), followed by the Indirect Made-in-Italy sector (44% and 28%, respectively) and other sectors (9% and 19%, respectively).

The groups of firms differed in size (turnover), with FMNEs being three times larger than UNINATs, FMNEs' labour costs about 1.5 times higher than UNINATs' and the proportion of highly skilled workers about 1.6 times higher in FMNEs than UNINATs. With regard to foreign and young (under 30 years old) employees, UNINATs had a higher proportion (Table 5).

[4]Pavitt's (1984) classification is based on firms' technological trajectories. Specifically, firms were considered to be in one of four categories: supplier-dominated, production-intensive (scale-intensive), production-intensive (specialist-suppliers) and science-based.

Table 5 Descriptive statistics for UNINATs and FMNEs

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
	UNINATs				
Turnover 2013	6822	5696.71	19,211.71	0	739,840
Labour costs 2013	6732	33.072	12.15	0	95
Share of highly skilled workers 2014	6822	0.177	0.23	0	9
Share of foreign workers 2014	6822	0.150	0.21	0	1.5
Share of under 30 workers 2014	6822	0.307	0.24	0	3
	FMNEs				
Turnover 2013	131	37,713.45	64,226.02	283	373,833
Labour costs 2013	131	49.626	13.252	4	89
Share of highly skilled workers 2014	131	0.293	0.175	0	0.81579
Share of foreign workers 2014	131	0.089	0.109	0	0.536232
Share of under 30 workers 2014	131	0.211	0.139	0	0.6

4.2 *Econometric Analysis*

The counterfactual analysis consisted of a logit model and an ATT.[5] The explanatory variables used for the logit model were turnover in 2010 and Pavitt's (1984) macro-sectors.

The results of the logit regression confirmed the findings of the descriptive statistics: FMNEs were larger in terms of turnover than UNINATs and tended to operate in the Indirect Made-in-Italy and other (scale-intensive and science-based) sectors (Table 6). This is consistent with evidence that, on average, UNINATs specialise more in traditional sectors (Direct Made-in-Italy), while affiliates of foreign MNEs are more specialised, technology-oriented and innovative.

There were 86 treated (FMNEs) and 4856 untreated firms (UNINATs). The ATT estimation shows that FMNEs paid higher wages than UNINATs, confirming the results of previous studies, and hired more highly skilled workers than UNINATs. UNINATs tended to hire younger workers and foreign workers (Table 7). This may be explained by the fact that MNEs need to reduce the liability of foreignness (Nachum 2003; Goerzen et al. 2013) by employing experienced national and local workers.

[5]The model was run in STATA14, using the nearest neighbour matching method (random draw version) with replacement and caliper (=0.01) and conditioning on common support.

Table 6 Logistic regression

Variable	Coefficient
Turnover 2010 (ln)	0.9943***
Indirect Made-in-Italy	0.8768***
Other sectors	0.9837***
Constant	−12.9818***
Number of observations	5729
Prob > chi^2	0.0000
Pseudo R^2	0.2084
Log likelihood	−445.9296

Note:*** is significant at 10%, 5% and 1% levels, respectively

Table 7 ATT estimation

Variable	Year	UNINATs	FMNEs	ATT	Standard Deviation	Significance
Share of highly skilled workers	2014	4856	86	0.057	0.021	Significant
Share of under 30 workers	2014	4856	86	−0.042	0.020	Significant
Share of foreign workers	2014	4856	86	−0.040	0.016	Significant
Labour cost per employee	2013	4856	86	6.702	1.555	Significant

Specifically, MNEs located in IDs tended to use, and foster, local experienced and highly skilled workers, boosting the possibility of generating knowledge spillovers.

5 Conclusions

Attracting IFDIs has become one of the main goals of local and regional development policies because foreign investment brings larger-scale, more capital-intensive or more technically advanced methods of production. Foreign MNEs are driven to locate where they can benefit from localisation externalities: the more a region is specialised or dense in one sector, the more it attracts foreign investment within the same sector. In the case of Italian IDs, the endowment of scientific and technological infrastructure, qualified localised capabilities and specifically local industrial commons are pivotal location factors for foreign MNEs.

The results of the counterfactual analysis underline that FMNEs are larger in terms of turnover, pay higher wages and employ greater proportions of highly skilled workers than UNINATs. FMNEs hire more workers who are older than 30 and non-foreign. This relates to the need for foreign MNEs to reduce the liability of foreignness by hiring more experienced workers who are embedded in the local environment. This propensity by FMNEs to hire local workers who, in the Italian context, are presumably more skilled, may trigger a concentration of specialist workers, fostering the circulation of know-how and knowledge spillovers (e.g. Capello and Lenzi 2015) and enabling human capital regeneration and development. Thus, FDIs contribute positively to regional socio-economic development by sustaining the industrial commons of the area in which it is located through hiring experienced, local and highly skilled workers. The analysis highlights that, compared with UNINATs, a higher proportion of FMNEs operates in nontraditional sectors (e.g. scale-intensive and science-based sectors).

The presence of FMNEs in other sectors may generate a recombination of knowledge domains that complement the Made-in-Italy know-how held in UNINATs. The areas in which FMNEs are located may benefit from the creation and diffusion of new knowledge and innovation. Foreign MNEs are more influential and therefore able to capture novelties and market changes and absorb contextual knowledge produced locally (e.g. Belussi and Asheim 2010). Different effects may spring from foreign MNEs' presence, depending on their sector of specialisation. Indeed, FMNEs specialising in the ID sector may be more likely to experience positive intraindustry spillovers which, in the medium to long run, may lead to "lateral" spillovers, such as effects relating to the creation of an international atmosphere within the ID (see Mariotti et al. 2008). This atmosphere triggers district firms' international growth, thus affecting the district's labour composition. These issues might be further investigated in order to better understand the role played by foreign MNEs in the evolution and skills composition of IDs, and tailored policies might be developed and recommended.

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Appendix

Table 8 Firm location factors

Category	Factors
Traditional location factors	Labour (labour costs and availability, labour skills and labour unionisation) Market (market size and market potential, competitiveness level and density) Land (land costs and availability) Agglomeration economies (localisation economies, urbanisation economies) Transportation costs Other costs (taxes and financing)
Infrastructure, services and intangible assets	Presence of and accessibility to infrastructure Quality of utilities Business services (banking and financial services) Scientific and technological assets
Environmental and social context	Social cohesion and sense of legality Economic, political and social stability Legal system Intellectual property rights protection Bureaucratic efficiency
Policy framework	Competition policy Trade policy Tax policy Environmental policy
Information costs	Geographical distance from the core (of city, region, nation) Geographical proximity to the home country Cultural proximity between home and host countries FDI penetration

Source: Mariotti (2015)

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Part II
Agglomerations and Firms' Performance

Marshallian Industrial District Evolution: Technological Impacts and Firms' Heterogeneity

Jose-Luis Hervas-Oliver, Liney Manjarres-Henríquez, and Carles Boronat-Moll

Abstract This paper adds to the literature by deconstructing knowledge heterogeneity for the understanding of cluster evolution. Starting from the distinction between sustaining and radical innovations, as moderators of knowledge heterogeneity in Marshallian industrial districts (MIDs), this study's objective consists of answering the question why and how districts evolve, through the understanding of the differing processes creating knowledge, i.e. sustaining and radical, and the *type of firms* that do so, and analysing critical issues such as how *technological changes* affect the pattern of district evolution. Theoretical development states that (1) in MIDs radical disruption can be expected to be led by new firms and not by incumbent technology gatekeepers (TGs), which are mainly oriented to providing incremental innovations in order to maintain their status quo and centrality, and (2) in MIDs leading incumbents demonstrate predominantly an orientation towards the creation of sustaining knowledge in dense and orchestrated networks and aim to develop competence-enhancing variety which ensures their centrality and the status quo, making clusters evolve expanding central stages, i.e. specialization. Our argumentation has also challenged a central assumption in MIDs about leading incumbents: the type of knowledge necessary to challenge leading incumbents must be new to the industry and to the district, based on exploratory district boundary-spanning, technology-distant knowledge.

Keywords Cluster evolution · Radical innovation · Marshallian industrial districts · Innovation

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1 Introduction

While there is no doubt about the important source of competitiveness clusters[1] exert on regions and firms (e.g. Saxenian 1990), the understanding of a cluster's evolution over its life cycle still constitutes an emerging topic in the cluster literature (e.g. Menzel and Fornalh 2010; Boschma and Fornahl 2011; Trippl et al. 2015; Fornahl et al. 2015). Assuming that a district moves through its life cycle depending on whether there is an increase or decrease of knowledge heterogeneity among the district's organizations (Menzel and Fornalh 2010), this paper adds to that literature by deconstructing knowledge heterogeneity for the understanding of cluster evolution.

In doing so, this paper distinguishes between sustaining and radical innovations, as moderators of the knowledge heterogeneity in districts, presenting a clear-cut distinction between sustaining knowledge, along an existing technological trajectory (in the sense of Dosi 1988), and evolution caused by disrupted "turns" from radical innovation creating new technological trajectories. These different changes may produce different trajectories. We differentiate sustaining versus radical following the Christensen (1997) approach. On the one hand, Christiansen described what he called "sustaining technologies", technological developments that help organizations to make marginal improvements in what they are doing. These require only gradual change and pretty much retain the status quo. On the other hand, there are what Christensen termed disruptive technologies. These are wild and unexpected technological breakthroughs that require corporations to radically rethink their very existence. At first they seem of limited interest, but eventually they completely overturn existing products and markets. Christensen quotes the examples of the mobile phone (which took the wind out of the sails of fixed-line operators), digital photography (which sent sales of camera film plummeting and caused Kodak to change its whole business model) and online retailing (which continues to bruise many a traditional retailer).[2] The process of deconstruction of knowledge heterogeneity in clusters is performed through elaborating a cross-fertilization and integration of MIDs (Marshallian industrial districts) and the managerial and innovation literature. Its combination and intersection permits us to decipher the mechanisms and effects of the differing types of knowledge in clusters.

This study's objective consists of unfolding Marshallian industrial disctrict evolution, through the understanding of the differing processes creating knowledge, i.e. sustaining and radical, and the *type of firms* that do that, and analysing critical issues such as how *technological changes* affect the pattern of district evolution (see Menzel and Fornalh 2010; Fornahl et al. 2015).

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[1]We focus on clusters and also on industrial districts. In this paper industrial district and cluster are used indistinctively, although we recognize in the former intensive social capital processes following Becattini (1979).

[2]Extract from the *Economist*, http://www.economist.com/node/13636558
Disruptive/technology innovation

2 Sustaining Knowledge: The Power of Leading Incumbents or TGs

As commented by Hervas-Oliver and Albors-Garrigos (2014) and Hervas-Oliver (2016), within industrial districts, leading incumbents or technology gatekeepers (TGs) are focal companies or agents which mobilize knowledge, orchestrate the district by attracting investments, provide a vision for nurturing innovation and supply technological knowledge to local firms (Baglieri et al. 2012). These large leading firms, with high absorptive capacities and high R&D expenditures, shape a district's learning process (e.g. Lorenzoni and Lipparini 1999) by making significant investments in searching, learning and diffusing knowledge within their own networks for the purpose of preserving their existing technological trajectories and technological paradigms. They lead and orchestrate local SMEs, driving them through the different new technologies. These leading firms, however, decide and orchestrate what new technologies are going to be transferred throughout the network of small SMEs. The latter depend on those leading firms for innovation and technology learning.

Similarly, these leading firms, however, may oppose the adoption of new disruptive knowledge that challenges their dominance with the purpose of maintaining the status quo and their central positions in the district's networks, constraining networks and fostering inertia (e.g. Allarakhia and Walsh 2010). As such, these incumbents are embedded in routines and channels which may become inert and hard to change and adapt to new radical or disruptive innovations. Following Hervas-Oliver (2016), one of the disadvantages in districts occurs due to the fact that excessive geographic proximity allows district members to be more prone to inertia than organizations outside clusters (e.g. Pouder and John 1996; Glasmeier 1991), lock-in or myopia (Martin and Sunley 2006). This process is triggered by local managers' biased models oriented towards imitating other local managers, a fact especially observed among leading incumbents (e.g. Glasmeier 1991) that may result in lock-in driven mainly by leading incumbents unable or unwilling to change and adopt radical changes (Leonard-Barton 1992; Henderson 1993). As Pouder and John 1996: 1207) posit:

> Mental models based primarily on local competitors will be biased toward those competitors; at the same time they will direct attention away from outside competitors. Consequently, as local competitors increasingly dominate the perceptions of managers in the hot spot, competitors outside of the industry will be subject to less rigorous scrutiny....

Specifically, leading companies will impose technological trajectories on the firms in their networks, and the SMEs will direct attention only to the technology displayed or transferred from those leading firms that orchestrate the local networks.

In MIDs, therefore, leading firms are mainly responsible for upgrading industrial districts (e.g. Belussi and Sedita 2009), shaping a district's learning process (e.g. Lorenzoni and Lipparini 1999; Munari et al. 2011), as long as that knowledge is sustaining, a fact that can promote lock-in in the long term, but make IDs advance and extend their central stages.

3 Radical Innovation: Types of Firms and District Evolution

Following Hervas-Oliver (2016), and sticking to the radical knowledge point, MID literature did not explicitly tackle disruption, as long as literature on industrial districts implicitly assumes circumstances of continuous or sustaining innovation generation, especially when the networks governing clusters[3] are said to be of the "old" Marshallian district kind (c.f., Garofoli 1991; Robertson and Langlois 1995), to the extent that its application to the MID realm has been almost absent.

Radical knowledge, following innovation literature, comes from outside the district's (and industry) focal thematic knowledge (see Gilbert 2012). On this point, innovation literature points out[4] that searching in novel areas contributes to the establishment of new dominant technological designs, emphasizing that exploration enables better knowledge creation outside the existing technological core focus (Jiang et al. 2010).

How are new firms considered in the district literature? Overall, new firms are not a central part of the industrial district model, although they are mentioned for the spin-off process. From technology and innovation literature, new firms are not constrained by obsolete technology nor embedded in routines and channels difficult to change (e.g. Leonard-Barton 1992), and existing incumbents tend to be more limited by their existing knowledge that can even constitute a trap (Henderson 1993). In fact, it is widely accepted that new regional entrepreneurial firms (Feldman and Francis 2006) or external to the region ones and their competences (Wolfe and Gertler 2006) are necessary to sustain and rejuvenate clusters.

In this vein, cluster literature has stressed the necessity of new firm entrance in order to renew clusters, a fact less researched in MIDs. Thus, Eisingerich et al. (2010) posit that network openness (membership diversity, acceptation of new members and ties to organizations outside the district) improves district performance. As Tödtling and Trippl (2004a) suggest, the renewal of clusters implies also the renewal of networks, which implies the entrance of new firms with new knowledge. The study of the Viennese biotech district (Tödtling and Trippl 2004b; Trippl and Tödtling 2007) has shown how the formation of new spinoffs, and/or the entrance of new foreign companies, can renew clusters. Similarly, as explained by Saxenian (1990), one of the key factors to explain Silicon Valley's renewing capacity is the continuous entrance of new firms which produced *a revolt against the established semiconductor firms* (Saxenian 1990, p.91). New firms imply new ties and the emergence of new structural forms of networks. New knowledge requires new firms which rejuvenate old rigid trajectories and locked networks and facilitate the entrance of new knowledge (Cho and Hassink 2009). As Crespo et al.

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[3]We focus on both Marshallian industrial districts and other cluster types and use the terms interchangeably throughout the paper. However, following Becattini (1979), we recognize the role of intensive social capital processes said to be typical of the industrial district model.

[4]See also Fleming and Sorenson (2004) and Ahuja and Lampert (2001).

(2014) state, the entrance of new firms brings new knowledge, renewing networks and thus favouring district evolution. Similarly, disruption in clusters often needs knowledge from outside the thematic technology of the cluster (Menzel and Fornalh 2010; Gilbert 2012).

In sum, we propose the first and second propositions, also drawing from Hervas-Oliver and Albors-Garrigos (2014) and Hervas-Oliver (2016):

Proposition 1 In districts, new firms are more likely to search in novel (to the district) technology-distant areas and introduce technology-distant disruptive knowledge not already embedded in the existing dominant technological paradigm characteristic of the district.

Proposition 2 In districts, established and leading incumbent firms are more likely to search within the existing technology area and introduce technology-similar sustaining knowledge already embedded in the existing dominant technological paradigm characteristic of the district.

4 Technological Changes for MID Evolution: Exploration or Exploitation?

New entrepreneurial firms are the ones responsible for major revolutionary breakthroughs (Tushman and Anderson 1986; Baumol 2004), thanks to the fact that technological change is enabling new entrants to establish innovative and dominant technological designs. Dominant designs are characterized by new knowledge components which are embodied in, and integrated by, new architectures (Clark 1985). In this chain of thought, and following Tushman and Anderson (1986), technology is considered to evolve through periods of incremental change, punctuated by technological breakthroughs that either destroy or enhance a firm's competences in an industry. In general, *competence-destroying* discontinuities are initiated by new firms, while *competence-enhancing* actions are initiated by existing firms (Anderson and Tushman 1990). In districts as well, the reason new firms are better able to contribute to cluster renewal is that they are not handicapped by embedded and redundant existing knowledge.

Referring to the concepts of exploitation (refinement of existing technology) and exploration (invention of new ones), as expressed by March (1991) in respect of organizational learning, this paper builds on that idea and elaborates upon a disentangling of the learning process in districts and the types of knowledge generated. An excessive focus on exploitation may result in organizational myopia and competency traps (Levitt and March 1988). The reason why this occurs, according to the cluster literature, is that bounded rationality and path dependency in clusters (Martin and Sunley 2006) induce organizations to simply absorb local knowledge from the local context by just "being there" (Gertler 2003), thereby restricting the acquisition of knowledge choices to just a few (local) potential alternatives. In contrast, "going beyond local search" (Rosenkopf and Nerkar 2001) and exploring outside the local technology can result in an avoidance of lock-in or myopia. In this chain of thought, an exploration orientation is also linked to the idea of technology-distant knowledge. As Fleming and Sorenson (2004) state, a search in novel areas (technologically distant) increases the number of possible knowledge combinations, exposing R&D to new problem-solving techniques (Ahuja and Lampert 2001). Jiang et al. (2010) also present similar conclusions, pointing out the necessity to search in novel areas in order to contribute to the establishment of new dominant designs, emphasizing the fact that exploration permits better knowledge creation outside the existing technological core focus (e.g. March 1991). To sum up, integrating, we theorized that incumbent firms mainly initiate and generate knowledge which is competence-enhancing and related to their existing core technological focus, favouring the maintenance of the status quo and their centrality in their networks, whereas, in general, competence-destroying discontinuities are initiated by new firms searching beyond the cluster.

5 Integration of Ideas

The elaboration and explanations above make different predictions about the drivers of district evolution. We expect a clear-cut differing effect on district evolution from the distinction between sustaining knowledge creation, based on incremental (exploitative learning) innovation and evolution caused by disrupted (exploratory learning) "turns" from radical knowledge creation in districts. In districts, the generation of sustaining knowledge by existing firms is exploitative in nature and competence-enhancing and occurs mainly in the context of strong ties; and it is usually initiated by incumbent anchor tenants or technological gatekeepers. In contrast, the creation of disruptive knowledge is mainly initiated by new entrepreneurial firms, is exploratory in nature, competence-destroying and requires a context of extensive weak ties in order to grasp distant (to the cluster and technology dominance) knowledge. Each type of knowledge determines a different shift in a cluster's evolution and its technological life cycle. Lastly, we also expect that new entrants will use alliances to gain access to the incumbents' complementary resources and, similarly, incumbent TGs will also take advantage of those alliances in order to accelerate the access to the new knowledge and survive in the disruptive transition, in order to preserve centrality in the new technology.

In sum, we propose the third and fourth propositions, also drawing from Hervas-Oliver (2016) and Hervas-Oliver and Albors-Garrigos (2014):

Proposition 3 The generation of sustaining knowledge by existing incumbent firms is exploitative in nature, competence-enhancing and occurs mainly in the context of strong ties. It is usually initiated by incumbent leading firms and leads to the extension of district central stages.

Table 1 Summary of propositions: the technological evolution, types of knowledge and district impacts and evolution

Technical change	Sustaining	Radical
Technology	Competence-enhancing knowledge sustaining the same design, paradigm and technology	Competence-destroying knowledge and changes of paradigm
Networks	Based on strong ties among TGs. Existing networks pervasive	Based on weak ties (distant knowledge) and new firms participating. Networks rejuvenation
Performance consequences for the district life cycle	Incremental and sustaining established technological trajectory. Extension of the district central stages	Disruption (new technological trajectory) for and renewal of the MID
		Rejuvenation
Innovation	Incremental (sustained), based on a recombination of existing knowledge with new varieties of knowledge	Disruptive (radical), based on recombining some existing capabilities with completely new knowledge brought to the local knowledge domain
Type of learning orientation	Exploratory of minor significance, exploitative of major significance. All technology-related knowledge. Competence-enhancing knowledge	Basically exploratory and based on technology knowledge distant from the core focus. Competence-destroying knowledge
Existing firms and new entrants	No new firms at all, just established (leading) incumbent firms	Entrance of new firms: Spinoffs, startups and diversifiers from different industries

Source: Own

Proposition 4 The creation of disruptive knowledge is mainly initiated by new entrepreneurial firms, is exploratory in nature, competence-destroying and requires a context of extensive weak ties in order to grasp distant (to the district and technology dominance) knowledge. It is usually initiated by new firms and leads to the rejuvenation of a district.

In Table 1 we present a general summary of the concepts discussed above, understanding their integration as a model to analyse technological changes and impacts on industrial district evolution. See Table 1.

6 Conclusions

District evolution still needs a comprehensive theoretical framework in order to understand its drivers and evolutionary effects. Focusing on the particular case of MIDs, this paper's objective has consisted of answering the question why and how districts evolve, through the understanding of the differing processes creating knowledge, i.e. sustaining and radical, and the *type of firms* that do that. In doing so, two critical issues in conjunction are analysed for the purpose of deciphering

MID evolution: how *technological changes* affect the pattern of district evolution and which is the role of *firms and their heterogeneous capabilities*, as central actors in a multi-scalar perspective to understand evolution in districts, contributing to the study of districts and cluster evolution (see Trippl et al. 2015; Fornahl et al. 2015).

Our argument brings the following contributions to the innovation and district literature. New firms entering with technology-distant (to the district thematic knowledge) radical knowledge into industrial districts need to access and get involved in existing local networks. The reason is based on the fact that newcomers need to learn about the norms and rules and get involved into local social issues for knowledge diffusion. Also, radical technology diffusion needs to be decoded and translated to each MID specificity and its local language and assumptions. Overall, this necessity to access to local social issues and become involved in local networks may also imply leverage alliances with local incumbents, totally involved and part of the local society, in a win-win relationship, because as Hervas-Oliver (2016) and Hervas-Oliver and Albors-Garrigos (2014) argue, in MIDs, due to the socially strong ties, large leading firms control and shape small networks of SMEs and allying with those leading firms is necessary to access those networks of small firms.

To sum up, our model and developed propositions encompass a set of implications. First, in MIDs radical disruption can be expected to be led by new firms and not by incumbent TGs which are mainly oriented to providing incremental innovations in order to maintain their status quo and centrality. This proposition, however, does not imply that leading incumbents are not necessary for the radical change to occur, as they connect the novel knowledge with the existing one. But both new firms and district-distant knowledge are necessary. The reason is based on the fact that leading incumbent firms in MIDs are usually embedded in existing dominant frameworks and are more likely to oppose radical technological changes in order not to alter their status quo. This means that for new firms entering districts, they also need to access those leading firms that orchestrate and control local networks: the social ties, trust and reciprocity within those networks, making local leading firms essential in order to support a potential radical change. Put differently, these leading local incumbent firms can be necessary in order to diffuse new radical knowledge due to their control of local networks, thus facilitating knowledge recombination.

Second, in MIDs leading incumbents demonstrate predominantly an orientation towards the creation of sustaining knowledge in dense and orchestrated networks and aim to develop competence-enhancing variety which ensures their centrality and the status quo, making clusters evolve expanding central stages, i.e. specialization.

Third, our argumentation has also challenged a central assumption in MIDs about leading incumbents: the type of knowledge necessary to challenge leading incumbents must be new to the industry and to the district, based on exploratory district boundary-spanning technology-distant knowledge. That is to say, disruptive ideas must come from other industries, non-related technological fields and based on external linkages, forming in this way new technological trajectories which may renew clusters. If they do not, then leading incumbents would have an advantage over existing technological trajectories, due to the fact that their repository of knowledge is superior, with more experience and resources, and that a new entrepreneurial firm can be blocked. The more technologically distant is new knowledge compared with that existing in the established incumbent TGs' domain, the higher the probability that the new firms can succeed. The reason for this is that new firms are advantaged by not possessing redundant repositories of knowledge and cognitive filters which impede change. This idea is, to some extent, embryonic in some reflections made by the district literature, although Gilbert (2012) stressed the idea that radical changes originate from different focal-to-the-cluster industries. In this vein, also Menzel and Fornalh 2010: 231) theoretically predicted:

> Clusters can increase heterogeneity and renew themselves by enlarging their boundaries, either by integrating firms in the same industry, but in other places, or by integrating organisations in spatial proximity, but outside the thematic focus of the cluster.

All in all, it is worth pointing out that the key message from this theoretical elaboration is that the generation of incremental knowledge (by leading incumbents, engaging in strong ties, utilizing an exploitation approach and promoting competence-enhancing variety through incremental innovation) can facilitate the enlargement of the central stages of a district and the sustaining of existing technological trajectories, whereas the creation of disruptive knowledge (by new firms, engaging in weak ties and linked to distant non-related knowledge and presenting an exploration focus and developing competence-destroying knowledge variety through radical innovations) may lead to creation of new technological trajectories which may subsequently renew the district. In addition, our theoretical framework also allows the identification, ex-ante, of when a new technology could become disruptive in clusters.

Overall, this chapter's contributions point out the necessity to introduce technological change and firms' knowledge heterogeneity (incumbent versus new firms) in the district evolution debate, confirming empirically the suggestions formulated by recent literature (see Fornahl et al. 2015; Trippl et al. 2015), opening empirically a new road ahead to configure a research agenda on the understanding of clusters/ districts evolution: how much are leading incumbents (similar to technology gatekeepers) really contributing to district evolution? Also, it is important to stress that policymakers should understand the positive and contributory role of leading incumbents, but also their limited roles in generating disruptive knowledge, fostering new technological trajectories and renewal. Policymakers need, also, to understand the necessity to create new firms in clusters not limited by existing knowledge and routines.

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Where Should I Locate My Hotel? An In-Depth Analysis of the Cluster Effect on Hotel Performance

Angel Peiró-Signes, Marival Segarra-Oña, Rohit Verma, and Luis Miret-Pastor

Abstract In this paper we analyse economic data over a period of 5 years from the Smith Travel Research (STR) database using an event study technique to compare economic performance among a total of 27,207 hotels, 4339 of them located in US touristic clusters. The aim of the research is to determine if the cluster effect is affecting the economic performance of hotels. Hotels are segmented and compared to similar groups in terms of revenue, scale, location, and affiliation, and then each of the hotels within a touristic cluster is compared to a similar group of outside-cluster hotels. Though the mean values for economic performance are higher than those properties located in clusters, specific analysis suggests that the cluster effect is not affecting all the hotels in the same way and that property level influences the economic performance of hotels within a touristic cluster.

Keywords US touristic clusters · Cluster effect · Hotels' economic performance · Event studies · Location

1 Introduction

Despite the popularity of the cluster concept and considering that the tourism industry presents considerable spatial concentration levels, the study of touristic clusters, defined by Porter (1998) as geographical concentrations of interrelated

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firms and institutions, is quite recent (Michael 2003; Brown and Geddes 2007; Bernini 2009; Lazzeretti and Capone 2009; Weidenfeld et al. 2010).

The importance of geographical concentration and the evidence of the existence of industrial clusters have been widely studied through the years (Brusco 1982; Porter 1985; Krugman 1991; Porter 1998), following Marshall's seminal work (Marshall 1890). Indeed, the acceptance of the importance that clusters have for competitiveness has supposed an important change in the appraisal of the locating of businesses (Skålholt and Thune 2013; Ženka et al. 2014; De Miguel-Molina et al. 2011).

In line with this, Krugman (1991) focusses on the interaction between the structure of the market and economic geography, considering geographical concentration as the most obvious factor of the existence of dynamic economic activity. In this work we will interpret the existence and importance of specialised territories as clusters. There is a certain consensus that the implementation of the concept of tourism cluster is appropriate (Jackson and Murphy 2002); however, its use is very recent, and it still is in an embryonic stage (Nordin 2003).

Most of these studies have focussed on specific sectors such as tourism conventions (Bernini 2009), food and wine tourism (De Oliveira and Fensterseifer 2003), and especially touristic clusters in emerging economies (Erkus-Öztürk 2009; Sharma et al. 2007). However, in the hotel industry, there are few studies done (Edgar et al. 1994; Baum and Haveman 1997; Sharma et al. 2007; Canina et al. 2005), and there is still a research gap in understanding touristic clusters and hotel profitability, although it is recognised to be highly important in fostering innovation, among other benefits (Gomezelj 2016).

In a previous work, Peiró-Signes et al. (2015) identified the US touristic clusters and classified hotel properties as located in or out of geographical clusters, finding that being located in a cluster can lead to a better economic performance for hotels. Following this line of study, we argue that it is urgent to deepen the understanding of the profitability and performance of hotels related to cluster effects. This would make hotel managers aware of needed changes and enable them to provide the information necessary to make optimum decisions to maintain and improve their competitiveness.

2 Literature Review

Until the present, studies on tourism clusters have focussed mainly on the role played by territory, different actors, social and productive relations (Van Den Berg et al. 2001; Flowers and Easterling 2006), as well as in the knowledge transfer produced (Hallin and Marnburg 2008). When allocating, firms may consider aspects such as economic, legal, and political issues to facilitate location decisions (Jiang et al. 2006) and also accessibility, basic services, site costs, environmental regulations, industrialisation, labour availability, host taxes and incentives, host government cooperation, or exchange controls (MacCarthy and Atthirawong 2003). There is an academic consensus that some competitive advantages reside in the "know-how", in the capacities, in the information, in the motivation, or in the geographic externalities produced (Cook et al.

2007; Lazzeretti and Capone 2009). All of these are aspects related to the local business environment (Ingram and Roberts 2000) and aspects the competitors located outside the cluster find more difficult to obtain.

The definition of touristic clusters involves a high degree of complexity. On one hand, it involves private investments such as hotels, travel organisers, attraction and leisure activities but also public or hybrid (public-private) investments such as railroads, roads, museums, theatres, or municipal services and, on the other hand, public policy implications regarding personal and political security. So, the creativity and interaction among different local partners are increasingly playing a more important role (Richards and Wilson 2006; Novelli et al. 2006); also, the existence of tourism clusters is enabling areas to compete globally while working together locally (Erkus-Öztürk 2009; Novelli et al. 2006; Ferreira and Estevao 2009).

Signorini (1994) was the first to attempt to quantify the district effect,[1] showing that the productivity of companies within a district is greater than that of companies outside it. Subsequently, other studies have made similar comparisons focusing on different aspects such as the ability to export, the generation of externalities, and the ability to innovate (e.g. Melitz 2003; Cainelli 2008).

As known, the justification of a traditional manufacturing cluster is based on the fact that a specialised territory has access to more and better resources (Flyer and Shaver 2003; Tallman et al. 2004). Albeit, studies on these economies of localisation have been focussed almost exclusively on manufacturing industries mainly due to the difficulty of verifying the presence of external economies in the service industry (Canina et al. 2005). References to the tourism cluster can be found in Porter's seminal work (Porter 1998). Yet, studies that relate services sectors with cluster dynamics and regional policy aspects are in the minority (Berg et al. 2001), and cooperation and complementarities are important but understudied components of tourism clusters (Weidenfeld et al. 2011).

Tourism is an industry with a high degree of heterogeneity in its products, and these require expensive searches for the consumer (Fischer and Harrington 1996; Freedman and Kosová 2012). Specialised territories allow the consumer to have and to evaluate a variety of different services within the same area. These external economies based on demand are especially important in the service industry, due to the fact that location is an intrinsic part of the service offered, also considering related aspects such as gaining the customer's attention by evoking desired emotional responses in customers. When a company (public, private, or hybrid) invests in making a location more attractive, the rest of the businesses (e.g. hotels) located in their vicinity can also benefit, which also implies a positive externality.

Our study focusses on the analysis of economic results considering the agglomeration of hotels belonging to a touristic cluster as a follow-up to our previous research, where we identified the geographical clusters in the USA, using labour

[1] In this work, we consider it to be equivalent to dynamic concentration, synergic concentration, and cluster.

data from the US Bureau of Labour Statistics and applied location indicators and identified hotels inside and outside clusters, while also segmenting the properties attending to location, affiliation, and scale (see Peiró-Signes et al. 2015). Our findings showed that being located in a cluster improves the economic performance of hotels, and that luxury and upscale (referring to scale) and chain-managed hotels (referring to property), in clusters, obtained better results than hotels outside clusters in the same category. Our results clearly showed that chain hotels benefit from the synergies created by the cluster effect while other hotels do not. In this paper, deepening our previous findings, we will evaluate, one by one, the economic performance of 4339 hotels that were located in a cluster from 2007 to 2011 with regard to their comparison group, using an event methodology.

3 Research Model

Our research question asks if it is possible to find better economic performance along a period of time in hotels located in touristic clusters than those of the same category, price range, type, and location that are outside clusters, due to the benefits derived from the synergic concentration of firms and the generation of positive externalities.

There are different methods that have been used for cluster identification and the subsequent preparation of cluster maps. Porter (2003) applied simple statistical indexes based on the location quotient, which is appropriate for our analysis.

Considering our former study, we will check our hypothesis and split it into three subclaims:

H1: The economic performance of hotels located inside a touristic cluster remains better than hotels located outside

H1a: The economic performance of hotels located inside a low-concentrated touristic cluster remains better than hotels located outside

H1b: The economic performance of hotels located inside a medium-concentrated touristic cluster remains better than hotels located outside

H1c: The economic performance of hotels located inside a high-concentrated touristic cluster remains better than hotels located outside

As previous works alert us about heterogeneity within the cluster (Freedman and Kosová 2012; Cook and Pandit 2009) and that there are considerable differences among the different types of hotels (Segarra-Oña et al. 2012), we will analyse the effect of hotel segmentation based on the main hypothesis. Segmentation in the industry has been used basically to identify consumer characteristics or users' attitudes. In geographical terms, segmentation can be by country, region, city, town, and even neighbourhood, including urban, suburban, rural, and beach, by population density, size of city, or climate. In this paper, we segmented US hotels by location. According to STR (Smith Travel Research) data classification, we classified hotels into six groups: urban, suburban, airport, interstate, resort, and small metro/town.

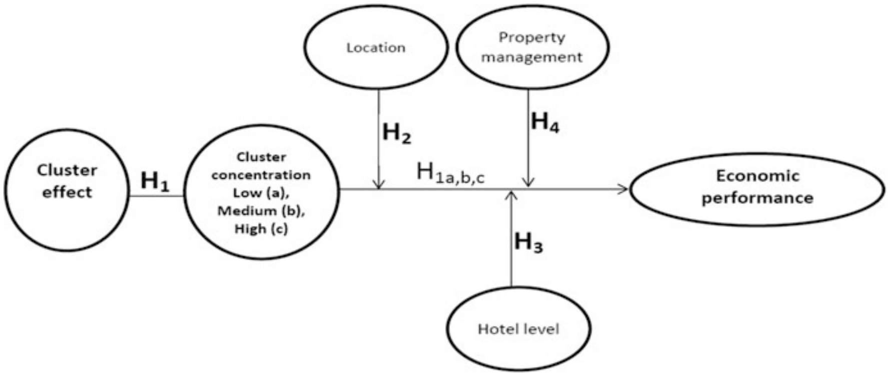

Fig. 1 Proposed model interactions

Thus, we put forward the following hypotheses:

H2 Property location influences the economic performance of hotels within a touristic cluster.

We also analysed the economic performance of hotels using a category segmentation whose validity has already been checked in previous works (Canina et al. 2005) and that considers luxury, upscale, midscale, economy, and budget; so, we propose the following:

H3 Property level influences the economic performance of hotels within a touristic cluster.

Yet, to better complete the analysis and considering previous results warning about the different performances of hotels depending on their management type (O'Neill and Carlbäck 2011; Perrigot et al. 2009; Botti et al. 2009), we studied the performance of hotels within the touristic clusters, taking into account if they were a franchise, belonged to a chain, or were independent. Therefore, we state the final hypothesis:

H4 Property management influences the economic performance of hotels within a touristic cluster.

The proposed research model is presented in Fig. 1.

4 Data Selection, Touristic Cluster Identification, and Methodology

The definition and identification of clusters can be found in the studies by Peiró-Signes et al. (2015). The same methodology had previously been used to study Spanish touristic clusters (Segarra-Oña et al. 2012) and on US touristic clusters classification (Peiró-Signes et al. 2015). The data used in the analysis was taken from

Table 1 Variables definition

PropSup	Number of rooms available that day (if daily data); number of room/nights available that month (monthly data)
PropDem	Number of rooms sold that day (if daily data); number of room/nights sold that month (monthly data)
PropRev	Room revenue ($US) for that day (or month)
CompSup	Number of competitors' rooms available that day (if daily data); number of competitors' room/nights available that month (monthly data)
CompDem	Number of competitors' rooms sold that day (if daily data); number of competitors' room/nights sold that month (monthly data)
CompRev	Competitors' room revenue ($US) for that day or month
#rooms	Number of rooms in a hotel
ZIP	US ZIP code
Operation code	Chain, franchise, independent, leased, owned
Scale	Economy chain through luxury chain; independents
Price	Pricing level (five levels: Budget, economy, midscale, upscale, luxury)
Location	Characteristics of location: Urban, rural, airport, interstate, etc.

the US Bureau of Labour Statistics (2010). We used geographic county areas officially recognised as geographical divisions, which makes the analysis more simple, understandable, and useful, especially for agents responsible for tourism planning and decision-making.

STR provided hotel performance data for the study. Data for the US market with the variables of supply, demand, revenue for each property, year, and month were provided, rising over 4 million data points. The main variables provided in the dataset and their definitions are shown in Table 1.

As we did not know how many properties were involved or if they varied along time, these variables (CompSup, CompDem, and CompRev) were dismissed. Our intention was to study hotel performance and evolution from 2007 to 2011 among properties inside touristic clusters and those outside these clusters. Therefore, previous data treatment was needed to handle the study.

First, we aggregated data for each year, so the variables of supply, demand, and revenue were aggregated, calculating the mean for the total months available in a year. Identification data remained as reported originally. Second, we calculated the main variables needed to make the study for each property and year. Variables and their definitions are shown in Table 2. Third, we restructured the database; so, data for each property was considered as a single case; that is, we joined all data available for each property in a single row, creating variables in a time basis (e.g. RevPAR2007 is the rooms' revenue per available rooms for the year 2007, RevPAR2008 is the RevPAR value for the year 2008, and so forth).

Fourth, we were interested in the evolution within the short-, medium-, and long-term, especially considering the crisis of 2007 as a benchmark year for the event study, following Hendricks et al. (2007). We selected 2007 because at that time the

Table 2 New variables created from the original dataset

Percentage of occupancy	The percentage of available rooms occupied for a given period. This is computed by dividing the number of paid guest rooms occupied for a period of time by the number of rooms available for the same period
Average daily rate	Total guest room revenue for a given period of time divided by the total number of paid occupied rooms during the same period
RevPAR	Room revenue divided by the annual number of available rooms

subprime mortgage crisis started in the USA, and that event has been conditioning the touristic market evolution in the USA. As a result, we dismissed data previous to 2007 and cases with missing data for the year 2007. At this point, we had a total of 27,207 properties for which data was available.

We had properties classified (Peiró-Signes et al. 2015), in touristic clusters and the rest—22,868 properties—outside touristic clusters. We used an event study technique to determine whether properties inside touristic clusters (a total of 4339) performed better than those outside (22,868 properties).

We followed in some way the methodology used by Barber and Lyon (1996) and, then, followed by others, like Hendricks et al. (2007), to select comparison groups for each property, although special adjustments were made to adapt them to our purposes and our reality. The first step was to determine a way to estimate performance.

Contrary to other industries, the hotel industry has peculiar aspects that make it difficult to use traditional measures (e.g. such as ROA) to evaluate performance. For example, many hotels are owned by chains, so individual results for each property are unavailable in many cases, or unrealistic in others, as they may not reflect individual property performance. Also, specific effects like location or price range are hidden by aggregated results.

Therefore, data on a property level is crucial for evaluating hotels' performance in this study. Demand, supply, and revenue data provided initially are clearly inappropriate for evaluating performance. Supply is a variable with little evolution within a property as it provides only the rooms available on sale each month, and this will change only because of property refurbishing interventions or property enlargements. Demand is an indicator of property evolution but is insufficient to compare within properties, as properties might not have the same available rooms (supply). Finally, revenue depends on the demand and property scale between other aspects; so, property revenue comparison will not show property performance or evolution.

Next, we built other variables that have been used to show property performance. First, occupancy (demand/supply) shows the efficiency of the property in filling the hotel. An industrial analogy is how well are they doing in using full production capacity. The average daily rate, ADR (revenue/demand), shows at which price hotels are able to sell their rooms and therefore how much the client will pay for the service. The RevPAR (revenue/supply) shows the economic efficiency of the property and how good the revenue is in the property per unit (room) and has been traditionally used as a performance indicator in the lodging industry (Chung and Kalnins 2001; Kalnins and Chung 2004). Note that RevPar is also ADR over occupancy.

We compared the performance of each firm belonging to touristic clusters against a preselected comparison group. To estimate if hotels in clusters had a better evolution than those outside the cluster, we estimated abnormal performance as the change in the sample firm's performance minus the change in the median performance of the comparison group (Hendricks et al. 2007). The change in the level of performance for both sample firms and comparison group is calculated comparing the level of performance in the studied year versus the level of performance in the base year (2007). This method is preferred over comparing each year with the previous year, as this might lead to biased results.

The change can be measured as a variation in the level of performance or a percentage of change in the level of performance. For measuring occupancy, both measures, ADR and RevPAR, can provide similar information, but we decided to track the disparity in the level of performance, as it seemed easier to interpret the data. Then the interpretation of an upturn of occupancy rate from 70% to 73% from 1 year to the next might be that the change in the level of occupancy is +3% rather than +4.28%. To better evaluate firms' performance, we chose, besides occupancy (Occ), ADR, RevPAR, the percentage of variance in demand and revenue.

As mentioned before, variance in supply is minimal, so there is no sense in keeping that variable. Additionally, the absolute variables of demand or revenue have no sense, as their value for the sample firm and the comparison group might be quite different; therefore, bias in either sense is possible.

To establish comparison groups, we focussed on RevPAR value. It has been used in previous works to study hotel performance, and it is closely related to operating profit per available room (Canina et al. 2005; Enz et al. 2008), which takes into account costs of operation. We checked this relationship as Canina et al. (2005) did using PKF Consulting Hospitality Research Group data. Pearson correlations between RevPAR and operational profit per available room from a group of 2740 properties with data from 2007 to 2010 (10,960 data points) was 0.813 ($p < 0.01$). This result suggests that both measures are strongly linked. As some error in this correlation might be due to different cost structures in each segment, we controlled for costs by assuring that comparison groups were in the same scale and with similar ADR value.

Following Barber and Lyon (1996), we decided that evaluating each firm against a portfolio of firms was better than using only one firm to compare with another, and, therefore, we used a step procedure to select the firms belonging to the comparison groups.

Some factors might have affected RevPAR, resulting in hiding the touristic cluster effect; therefore, we thought that we should control for this variability in the comparison groups. We controlled for location (urban, suburban, airport, interstate, resort, and small metro/town), affiliation (chain management, franchise, and independent), and scale (luxury chains, upper upscale chains, upscale chains, midscale with F&B chains, midscale without F&B chains, economy chains, and independents) within each comparison group. Price (luxury, upscale, mid-price, economy, budget) was not controlled directly by the correspondent variable as the region in which they are located can affect hotels. Hotels in highly populated regions are expected to have a higher ADR than those located in other regions; therefore, we considered controlling ADR and scale to be more accurate in terms of the similarity between the sample and the comparison group than controlling by price. For example, the ADR for a luxury hotel in the central USA might be far lower than the ADR for a luxury hotel in Manhattan or Boston.

To determine the comparison groups, we followed Barber and Lyon's (1996) guidelines to assure well-specified and powerful statistics and an adapted procedure from Hendricks et al. (2007) based on RevPAR value that was also used in other studies (Enz et al. 2014). We first identified for each property in the sample (in the touristic cluster) all the firms outside touristic clusters that had the same characteristics (location, affiliation, and scale) and that had a RevPAR within the 95–105% range of the sample firm for the benchmark year (2007), controlling for ADR to be in the 90–110% filter to guarantee the maximum similarity of the firms in each group. At the second stage, if no hotel was found at the first phase, the RevPAR filter was increased 5% on each side also controlling characteristics and ADR to be in the 90–110% range and property characteristics (location, affiliation, and scale). If no hotels were found, we maintained the RevPAR filter in the 90–110% range and the firms' characteristics filter, and we eliminated the ADR filter. Finally, if we did not find any firms in Step 3, we maintained the firms' characteristics filter, and we looked for the closest match in RevPAR.

After determining the sample's comparison groups, median values for each variable were calculated, as shown in Table 3. As the benchmark year was 2007, we had a total of four values for occ., ADR, RevPAR, percentage of variance of demand, and revenue for each sample firm.

Outliers can significantly affect the mean values of abnormal performance indicators; therefore, we ran non-parametric tests such as the Wilcoxon signed-rank test on the median values and the binomial sign test on the percentage of firms experiencing positive abnormal performance to help the interpretation of the results. Consistent with our hypotheses, we tested significance using the one-tailed test.

Finally, in order to test our hypotheses, we split the sample into three groups according to the cluster concentration classification made earlier in this paper. We considered low-, medium-, and high-concentrated clusters to check if the size of concentration of the cluster improves the hotel performance. Then, we ran the same statistics previously explained within each group considering location, affiliation, and hotel category.

Table 3 Median values for each variable analysed

	Properties in the sample	Average group size
Step 1	3760	33.41
Step 2	186	1.76
Step 3	162	11.02
Step 4	231	1.00

5 Empirical Results

Analysing the results, we will focus on non-parametric results to avoid the influence that outliers might cause on the mean results. The results of the overall sample (Table 4) provide evidence that in the first year after the subprime mortgage crisis, hotels in clusters were significantly (p-value $\leq$0.01) more affected than those outside the clusters, as can be seen in all the performance indicators. For example, the median change in RevPAR from 2007 to 2008 has been −$0.75 in sample firms compared to those in their comparison groups, and only 45.23% of the sample firms received better results than those in their comparison groups. These results are due to the reduction in the median occupancy level (−0.59%) and in the median ADR value (−$0.55), which, obviously, have been affected by the negative evolution of the demand and revenue (−1.04% and −1.50%, respectively).

Although this negative evolution in the first year continues in 2009, a small turnover occurs over the following years, but overall this is not a significant difference over the period of 2007 to 2011. Therefore, we can reject our first hypothesis that stated that in-cluster properties would perform better in the long term in a period of economic crisis.

To better understand what was happening and to check for hypotheses 2, 3, and 4, we segmented our sample, attending to their industry sector and quality levels (scale), their location, and their affiliation (chain, franchise, or independent), and we used the three cluster concentration categories already mentioned in this paper: low, medium, and high. The results of the segmented samples for RevPAR are shown in Tables 5, 6, 7 and 8. Results of ADR, occupancy, percentage of change in demand, and percentage of change in revenue—although not reported—were used to explain the results and are available from the authors.

Results for hotel level segmentation show quite a few differences that must be underlined. In-cluster properties belonging to the luxury segment show consistently better and greater results every year than those outside the clusters, as the mean, median, and percentage of positive abnormal results are always positive. For example, in the overall period, RevPAR increased in median by $2.87 more ($p$-value $\leq$0.01, mean $3.29, 58.03% positive) per year for in-cluster properties than those outside the cluster when other variables were controlled (location and affiliation).

For this segment and period, median ADR increased $0.93 per year and occupancy 0.12% per year, which means that RevPAR increased because of an ADR improvement rather than an occupancy improvement. Additionally, we look at the percentage of variance of demand and revenue. In this case, we see a significant increase in revenue.

Assuming supply is almost constant, we conclude that in-cluster properties in *luxury hotels* increased their RevPAR significantly over those outside clusters because of a larger increase in revenue.

On the other side, *mid-price to budget* in-cluster properties have stronger negative results than those outside clusters. In all cases, those differences are statistically significant, as shown in Table 5. Therefore, hotel level segmentation evidences how

Table 4 Abnormal changes in the performance results for the total sample

	2007–2008			2007–2009			2007–2010			2007–2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
N		4313			4311			4321			4341	
Abnormal change in the % of demand	0.02	*−1.04*	*46.49*	0.72	0.03	50.03	0.77	−0.32	49.22	0.37	−0.48	48.79
	(0.02)	*(−4.53)*[a]	*(−4.6)*[a]	(0.92)	(−0.57)	(−0.03)	(0.9)	(−0.91)	(−1)	(0.4)	(−1.61)	(−1.58)
Abnormal change in the % of revenue	−0.07	*−1.50*	*44.77*	0.54	−0.43	49.06	1.49	−0.32	49.41	**2.94**	**0.57**	51.05
	(−0.08)	*(−6.44)*[a]	*(−6.85)*[a]	(0.59)	(−0.81)	(−1.22)	(1.46)	(−0.22)	(−0.76)	**(2.62)[a]**	**(−2.58)[a]**	(−1.37)
Abnormal change in the occ	*−0.59*	*−0.59*	*46.64*	0.09	0.08	50.28	−0.10	−0.17	49.17	*−0.35*	−0.09	49.61
	(−4.36)[a]	*(−5.31)*[a]	*(−4.4)*[a]	(0.55)	(−1.02)	(−0.35)	(−0.53)	(−0.48)	(−1.08)	*(−1.69)*[c]	(−1.27)	(−0.5)
Abnormal change in the ADR	−0.07	*−0.55*	*45.41*	−0.10	−0.58	*47.01*	0.15	0.04	50.21	**1.53**	**0.81**	**52.70**
	(−0.22)	*(−3.97)*[a]	*(−6.01)*[a]	(−0.3)	(−3.4)[a]	*(−3.91)*[a]	(0.41)	(−0.12)	(−0.26)	**(3.94)[a]**	**(−5.76)[a]**	**(−3.54)[a]**
Abnormal change in the RevPAR	*−0.70*	*−0.75*	*45.25*	−0.13	−0.16	49.30	0.28	0.04	50.23	**1.46**	**0.27**	51.04
	(−3.05)[a]	*(−6.17)*[a]	*(−6.23)*[a]	(−0.55)	(−0.03)	(−0.9)	(1.05)	(−1.21)	(−0.29)	**(4.54)[a]**	**(−3.86)[a]**	(−1.35)

(continued)

Table 4 (continued)

	Cum.2009			Cum.2010			Cum.2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
N		4311			4311			4311	
Abnormal change in the % of demand	0.28	*−0.40*	*48.43*	0.41	*−0.33*	*48.55*	0.40	*−0.55*	*48.20*
	(0.39)	*(−1.82)*[c]	*(−2.04)*[b]	(0.54)	*(−1.88)*[c]	*(−1.89)*[c]	(0.51)	*(−2.17)*[b]	*(−2.35)*[a]
Abnormal change in the % of revenue	0.11	*−0.83*	*47.74*	0.51	*−0.88*	*47.78*	1.09	−0.42	48.78
	(0.13)	*(−3.64)*[a]	*(−2.95)*[a]	(0.57)	*(−2.35)*[a]	*(−2.89)*[a]	(1.16)	(−0.84)	(−1.58)
Abnormal change in the occ	−0.25	*−0.34*	*48.68*	−0.21	*−0.23*	48.84	−0.24	*−0.31*	*48.56*
	(−1.84)c	*(−1.96)*[b]	*(−1.72)*[c]	(−1.42)	*(−1.7)*[c]	(−1.51)	(−1.59)	*(−1.84)*[c]	*(−1.87)*[c]
Abnormal change in the ADR	−0.11	*−0.57*	*46.48*	−0.04	*−0.32*	*48.17*	0.35	−0.01	49.93
	(−0.36)	*(−3.69)*[a]	*(−4.61)*[a]	(−0.11)	*(−2.21)*[b]	*(−2.39)*[a]	(1.07)	(−0.53)	(−0.08)
Abnormal change in the RevPAR	*−0.43*	*−0.47*	*47.45*	−0.19	−0.34	*48.26*	0.22	−0.21	48.82
	(−1.95)[c]	*(−2.75)*[a]	*(−3.33)*[a]	(−0.86)	(−1.33)	*(−2.27)*[b]	(0.94)	(−0.64)	(−1.54)

Note. Results on abnormal changes. *T*-statistics for the mean, Wilcoxon signed-rank test *Z*-statistic for the median, and binomial sign test *Z*-statistic for the percent positive are reported in parentheses

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table 5 Abnormal changes in the performance results segmented by hotel level

	2007–2008			2007–2009			2007–2010			2007–2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Luxury		467			467			468			469	
	0.52	0.31	51.39	**2.13**	**2.30**	**56.75**	**3.13**	**3.32**	**57.48**	**7.15**	**5.18**	**60.13**
	(0.59)	(−0.37)	(−0.56)	**(1.91)**[c]	**(−2.7)**[a]	**(−2.87)**[a]	**(2.54)**[a]	**(−3.24)**[a]	**(−3.19)**[a]	**(4.88)**[a]	**(−4.99)**[a]	**(−4.34)**[a]
Upscale		1767			1766			1769			1775	
	−0.65	*−0.47*	*47.54*	−0.10	0.50	*52.04*	0.39	*0.91*	*53.42*	**1.74**	**1.49**	**54.42**
	(−1.4)	*(−2.13)*[b]	*(−2.05)*[b]	(−0.24)	(−1.43)	*(−1.69)*[c]	(0.81)	*(−2.41)*[a]	*(−2.85)*[a]	**(3.03)**[a]	**(−4.31)**[a]	**(−3.7)**[a]
Mid-price		1343			1338			1343			1349	
	−0.93	*−1.11*	*42.14*	−0.38	*−0.66*	*45.96*	−0.41	*−1.01*	*45.12*	0.05	−0.90	*46.03*
	(−4.04)[a]	*(−5.83)*[a]	*(−5.73)*[a]	(−1.29)	*(−2.25)*[b]	*(−2.93)*[a]	(−1.24)	*(−2.69)*[a]	*(−3.55)*[a]	(0.12)	(−1.1)	*(−2.89)*[a]
Economy		448			452			453			455	
	−1.44	*−1.44*	*40.63*	*−1.12*	*−0.70*	*44.03*	−0.42	−0.33	47.02	0.25	−0.81	46.59
	(−4.46)[a]	*(−4.89)*[a]	*(−3.92)*[a]	*(−2.74)*[a]	*(−2.48)*[a]	*(−2.49)*[a]	(−0.88)	(−1.13)	(−1.22)	(0.4)	(−0.68)	(−1.41)
Budget		288			288			286			291	
	−0.70	*−0.60*	*43.21*	*−1.29*	*−0.79*	*44.60*	−0.72	−0.39	47.37	−1.00	*−0.97*	45.52
	(−1.6)	*(−2.06)*[b]	*(−2.24)*[b]	*(−2.51)*[a]	*(−2.32)*[b]	*(−1.77)*[c]	(−1.3)	(−1.53)	(−0.83)	(−1.46)	*(−1.77)*[c]	(−1.47)

(continued)

Table 5 (continued)

	Cum.2009			Cum.2010			Cum.2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Luxury		467			467			467	
	1.31	**1.80**	**55.25**	**1.96**	**2.09**	**56.75**	**3.29**	**2.87**	**58.03**
	(1.43)	**(−2.07)[b]**	**(−2.22)[b]**	**(2.04)[b]**	**(−2.7)[a]**	**(−2.87)[a]**	**(3.19)[a]**	**(−3.63)[a]**	**(−3.42)[a]**
Upscale		1766			1766			1766	
	−0.40	−0.07	49.80	−0.14	0.30	51.61	0.33	**0.76**	**52.57**
	(−0.95)	(−0.08)	(−0.14)	(−0.34)	(−0.9)	(−1.33)	(0.73)	**(−2.36)[a]**	**(−2.14)[b]**
Mid-price		1343			1343			1343	
	−0.66	*−0.82*	*44.75*	*−0.58*	*−1.01*	*43.63*	−0.42	*−1.08*	*44.01*
	(−2.69)[a]	*(−4.06)[a]*	*(−3.82)[a]*	*(−2.21)[b]*	*(−3.8)[a]*	*(−4.64)[a]*	(−1.47)	*(−3.08)[a]*	*(−4.37)[a]*
Economy		447			447			447	
	−1.28	*−1.25*	*40.40*	*−0.99*	*−0.84*	*42.63*	*−0.68*	*−0.92*	*42.86*
	(−3.85)[a]	*(−3.92)[a]*	*(−4.02)[a]*	*(−2.81)[a]*	*(−2.9)[a]*	*(−3.07)[a]*	*(−1.74)[c]*	*(−2.08)[b]*	*(−2.98)[a]*
Budget		288			288			288	
	−1.00	*−0.56*	*44.25*	*−0.92*	*−0.49*	*44.60*	*−0.96*	*−0.55*	*42.51*
	(−2.19)[b]	*(−2.27)[b]*	*(−1.89)[c]*	*(−1.94)[c]*	*(−2.19)[b]*	*(−1.77)[c]*	*(−1.91)[c]*	*(−2.19)[b]*	*(−2.48)[a]*

Note. Results on abnormal changes. *T*-statistics for the mean, Wilcoxon signed-rank test *Z*-statistic for the median, and binomial sign test *Z*-statistic for the percent positive are reported in parentheses

First value indicated refers to the number of properties in the segment

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table 6 Abnormal changes in the performance results segmented by affiliation

	2007–2008			2007–2009			2007–2010			2007–2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Chain management		517			517			517			517	
	0.04	−0.62	47.00	−0.15	−0.13	49.13	0.54	0.21	50.68	**3.14**	**1.33**	53.00
	(0.06)	(−0.22)	(−1.32)	(−0.18)	(−0.2)	(−0.35)	(0.58)	(−0.93)	(−0.26)	**(2.79)[a]**	**(−3.01)[a]**	(−1.32)
Franchise		3218			3216			3222			3240	
	−0.82	*−0.88*	*43.86*	−0.07	−0.30	48.77	0.08	−0.17	49.15	**0.85**	−0.13	49.58
	(−4.95)[a]	*(−7.63)[a]*	*(−6.95)[a]*	(−0.35)	(−0.57)	(−1.38)	(0.36)	(−0.24)	(−0.95)	**(3.1)[a]**	(−1.32)	(−0.46)
Independent		578			578			580			582	
	−0.65	0.23	51.56	−0.45	0.55	52.60	1.13	**2.23**	**55.69**	**3.35**	**3.96**	**57.22**
	(−0.51)	(−0.44)	(−0.71)	(−0.39)	(−0.71)	(−1.21)	(0.89)	**(−2.3)[b]**	**(−2.7)[a]**	**(2.16)[b]**	**(−3.63)[a]**	**(−3.44)[a]**

(continued)

Table 6 (continued)

	Cum.2009			Cum.2010			Cum.2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Chain management		517			517			517	
	−0.06	−0.34	48.16	0.14	−0.25	48.74	0.89	0.17	50.48
	(−0.08)	(−0.26)	(−0.79)	(0.19)	(−0.29)	(−0.53)	(1.12)	(−1.23)	(−0.18)
Franchise		3216			3216			3216	
	−0.45	*−0.56*	*46.60*	−0.29	*−0.46*	*47.09*	0.00	−0.40	*47.44*
	(−2.62)[a]	*(−3.84)*[a]	*(−3.84)*[a]	(−1.56)	*(−2.61)*[a]	*(−3.28)*[a]	(−0.01)	(−1.34)	*(−2.89)*[a]
Independent		578			578			578	
	−0.59	0.54	51.73	0.03	1.18	**54.50**	0.89	**2.06**	**55.02**
	(−0.52)	(−0.62)	(−0.79)	(0.03)	(−1.43)	**(−2.12)**[b]	(0.73)	**(−2.63)**[a]	**(−2.37)**[a]

Note. Results on abnormal changes. T-statistics for the mean, Wilcoxon signed-rank test Z-statistic for the median, and binomial sign test Z-statistic for the percent positive are reported in parentheses

First value indicated refers to the number of properties in the segment

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table 7 Abnormal changes in the performance results segmented by location

	2007–2008			2007–2009			2007–2010			2007–2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Urban		308			313			314			314	
	2.81	**4.14**	**65.91**	**4.63**	**5.64**	**64.54**	**7.00**	**6.94**	**69.43**	**12.03**	**13.30**	**74.84**
	(3.6)[a]	**(−5.17)[a]**	**(−5.53)[a]**	**(5.55)[a]**	**(−5.92)[a]**	**(−5.09)[a]**	**(6.97)[a]**	**(−7.4)[a]**	**(−6.83)[a]**	**(10.39)[a]**	**(−9.7)[a]**	**(−8.75)[a]**
Suburban		995			993			995			998	
	−0.85	*−1.46*	*38.69*	*−0.76*	*−0.90*	*44.11*	*−1.39*	*−1.35*	*41.91*	*−0.87*	*−1.26*	*43.99*
	(−3.1)[a]	*(−6.81)*[a]	*(−7.1)*[a]	*(−2.42)*[a]	*(−3.55)*[a]	*(−3.68)*[a]	*(−3.67)*[a]	*(−5.06)*[a]	*(−5.07)*[a]	*(−1.94)*[c]	*(−3.56)*[a]	*(−3.77)*[a]
Airport		137			136			137			137	
	−2.32	*−2.69*	*35.77*	−1.21	−1.35	44.85	*−2.03*	*−1.57*	*40.88*	*−2.15*	*−1.86*	43.07
	(−3.41)[a]	*(−3.8)*[a]	*(−3.25)*[a]	(−1.46)	(−1.62)	(−1.11)	*(−2.2)*[b]	*(−2.46)*[a]	*(−2.05)*[b]	*(−2.19)*[b]	*(−2.04)*[b]	(−1.54)
Interstate		729			729			731			735	
	−0.97	*−0.66*	*44.31*	*−0.83*	*−0.60*	*45.82*	−0.48	−0.25	48.56	−0.24	−0.43	48.30
	(−3.95)[a]	*(−4.04)*[a]	*(−3.04)*[a]	*(−2.45)*[a]	*(−2.06)*[b]	*(−2.22)*[b]	(−1.22)	(−0.71)	(−0.74)	(−0.5)	(−0.39)	(−0.89)
Resort		936			935			935			941	
	−1.86	*−0.89*	*45.62*	−0.80	0.76	52.30	−0.16	0.70	52.30	1.05	−0.44	49.20
	(−2.1)[b]	*(−2.98)*[a]	*(−2.65)*[a]	(−0.93)	(−0.07)	(−1.37)	(−0.17)	(−0.67)	(−1.37)	(0.95)	(−0.4)	(−0.46)
Small metro/ town		1208			1205			1207			1214	
	−0.22	*−0.49*	*46.81*	0.21	0.01	50.00	**0.97**	**0.51**	**52.49**	**2.39**	**1.45**	**54.58**
	(−0.81)	*(−2.67)*[a]	*(−2.19)*[b]	(0.59)	(−0.68)	0.00	**(2.54)[a]**	**(−2.32)[b]**	**(−1.7)[c]**	**(4.8)[a]**	**(−4.73)[a]**	**(−3.16)[a]**

(continued)

Table 7 (continued)

	Cum.2009			Cum.2010			Cum.2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Urban		308			308			308	
	3.69	**4.56**	**66.88**	**4.82**	**5.45**	**66.88**	**6.63**	**6.86**	**71.75**
	(5.05)[a]	**(−5.78)**[a]	**(−5.87)**[a]	**(6.15)**[a]	**(−6.63)**[a]	**(−5.87)**[a]	**(8.01)**[a]	**(−8.02)**[a]	**(−7.58)**[a]
Suburban		995			995			995	
	−0.81	*−1.26*	*40.30*	*−1.01*	*−1.25*	*40.90*	*−0.96*	*−1.34*	*40.50*
	(−3.04)[a]	*(−5.34)*[a]	*(−6.09)*[a]	*(−3.49)*[a]	*(−5.5)*[a]	*(−5.71)*[a]	*(−3.03)*[a]	*(−4.99)*[a]	*(−5.96)*[a]
Airport		137			137			137	
	−1.79	*−2.45*	*39.42*	*−1.87*	*−2.51*	*37.23*	*−1.94*	*−1.90*	*38.69*
	(−2.54)[a]	*(−2.99)*[a]	*(−2.39)*[a]	*(−2.53)*[a]	*(−2.98)*[a]	*(−2.9)*[a]	*(−2.53)*[a]	*(−2.76)*[a]	*(−2.56)*[a]
Interstate		728			728			728	
	−0.84	*−0.56*	*45.13*	*−0.72*	*−0.44*	47.05	*−0.59*	−0.52	*46.36*
	(−3.14)[a]	*(−2.99)*[a]	*(−2.59)*[a]	*(−2.44)*[a]	*(−2.12)*[b]	(−1.56)	*(−1.83)*[c]	(−1.62)	*(−1.93)*[c]
Resort		936			936			936	
	−1.34	−0.20	49.68	−0.93	0.18	50.85	−0.41	0.11	50.43
	(−1.62)	(−1)	(−0.16)	(−1.12)	(−0.29)	(−0.49)	(−0.48)	(−0.15)	(−0.23)
Small metro/town		1207			1207			1207	
	−0.04	−0.25	49.05	0.28	−0.08	49.63	**0.80**	**0.41**	51.20
	(−0.16)	(−0.78)	(−0.63)	(0.95)	(−0.37)	(−0.23)	**(2.43)**[a]	**(−1.93)**[c]	(−0.81)

Note. Results on abnormal changes. T-statistics for the mean, Wilcoxon signed-rank test Z-statistic for the median, and binomial sign test Z-statistic for the percent positive are reported in parentheses

First value indicated refers to the number of properties in the segment

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

Table 8 Abnormal changes in the performance results segmented cluster concentration

	2007–2008			2007–2009			2007–2010			2007–2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Low concentrated		3043			3046			3050			3064	
	−0.26	*−0.66*	*45.60*	0.41	0.01	50.05	*0.73*	0.06	50.48	*2.24*	*0.67*	*52.37*
	(−1.42)	*(−4.07)*[a]	*(−4.84)*[a]	(1.82)[c]	(−1.05)	(−0.04)	*(2.84)*[a]	(−1.41)	(−0.51)	*(6.84)*[a]	*(−5.23)*[a]	*(−2.6)*[a]
Medium concentrated		890			889			890			895	
	−1.44	*−1.08*	*43.71*	*−1.42*	*−0.61*	*46.57*	−0.53	−0.20	49.78	−0.15	−0.06	49.83
	(−3.73)[a]	*(−4.74)*[a]	*(−3.72)*[a]	*(−2.95)*[a]	*(−1.93)*[c]	*(−2.01)*[b]	(−1.01)	(−0.16)	(−0.1)	(−0.23)	(−0.15)	(−0.07)
High concentrated		380			376			379			380	
	−2.44	*−0.76*	46.32	−1.49	−0.04	50.00	−1.43	−0.17	49.08	−1.06	−2.57	*42.89*
	(−1.27)	*(−1.95)*[c]	(−1.39)	(−0.88)	(−0.22)	0.00	(−0.78)	(−0.2)	(−0.31)	(−0.52)	(−1.02)	*(−2.72)*[a]

(continued)

Table 8 (continued)

	Cum.2009			Cum.2010			Cum.2011		
	Mean	Median	% pos.	Mean	Median	% pos.	Mean	Median	% pos.
Low concentrated		3041			3041			3041	
	0.07	−0.28	*48.13*	0.29	−0.24	48.65	*0.78*	−0.07	49.57
	(0.38)	(−1.28)	*(−2.05)*[b]	(1.44)	(−0.36)	(−1.47)	*(3.54)*[a]	(−1.6)	(−0.45)
Medium concentrated		890			890			890	
	−1.45	*−0.96*	*44.16*	*−1.15*	*−0.74*	*46.52*	*−0.91*	−0.63	*46.74*
	(−3.57)[a]	*(−3.22)*[a]	*(−3.45)*[a]	*(−2.74)*[a]	*(−2.09)*[b]	*(−2.04)*[b]	*(−1.99)*[b]	(−1.21)	*(−1.91)*[c]
High concentrated		380			380			380	
	−2.00	−0.02	50.00	−1.78	−0.14	49.47	−1.58	−0.58	47.63
	(−1.16)	(−0.83)	0.00	(−1.03)	(−0.38)	(−0.15)	(−0.9)	(−0.45)	(−0.87)

Note. Results on abnormal changes. *T*-statistics for the mean, Wilcoxon signed-rank test *Z*-statistic for the median, and binomial sign test *Z*-statistic for the percent positive are reported in parentheses

First value indicated refers to the number of properties in the segment

[a]Significantly different from zero (50% in the case of percent positive) at the 1% level for one-tailed test

[b]Significantly different from zero (50% in the case of percent positive) at the 2.5% level for one-tailed test

[c]Significantly different from zero (50% in the case of percent positive) at the 5% level for one-tailed test

strategic orientation is affecting the results, as upper-priced in-cluster properties have significantly better results than those outside clusters, and in *mid-low* priced hotels, it works the other way around. Figure 2 shows more clearly this difference in accumulated RevPAR change.

Table 6 suggests that *chain management* or *franchise* hotels are not different, whether inside or outside of the cluster. According to the results shown in Table 6, we should underline the significantly better results of in-cluster *independent* hotels over those *independents* in outside clusters.

When we segmented the sample by property location, we immediately saw an extraordinary difference between the results in in-cluster urban properties and those outside clusters. By the year 2011, almost 75% of in-cluster urban properties had better results than their comparison group, with a median increase of the RevPAR of \$6.86 (per year from 2007 [p-value ≤ 0.01]). Again, ADR, occupancy, percentage of change in demand, and revenue were also significantly higher (p-value ≤ 0.01), although the increase was higher in revenue than in demand. On the other hand, in-cluster suburban and airport hotels performed significantly worse (p-value ≤ 0.01) than those outside clusters, while in-cluster resort and metro/town properties over the studied period seemed to perform similar to their comparison groups (See Table 7 and Fig. 3).

Finally, segmentation of the sample by cluster concentration (LQ level) showed that properties in low-concentrated clusters have better results than those in medium- or high-concentrated clusters (See Table 8).

Our analysis of the performance between in-cluster and out-cluster properties shows that a negative economic environment affects in-cluster properties more, especially in the short term. The first effect might be caused because of the relative impact that negative economic evolution has on nondiversified economies. Touristic clusters rely on single touristic attractions (e.g gaming in Las Vegas or Atlantic City or theme parks in Orlando); therefore, hotel properties are more sensitive to a variance in the demand for touristic attractions, as no other factor is supporting the industry. On the other hand, touristic clusters have more strength to face adverse conditions, and they have more resources, higher economy scales, and a higher influence in the sales channel, which should lead to a quicker recovery of the performance indicators as the economy takes again the path of growth.

Even when general performance is not positive, some in-cluster properties in selected segments have shown extraordinarily better results over their comparison groups, while other segments have behaved oppositely. Analysing results will lead us to say the upper-priced urban hotels in touristic clusters have performed far better than similar properties located outside clusters, even in the first steps of an economic crisis. This might be for various reasons; urban hotels are often located near touristic attractions, and tourists prefer to be within walking distance of tourist attractions, so there is usually a higher demand for these types of properties. Results are in accordance with previous studies that focus on the necessity to identify differences between segments, indicating a need for unique combinations of skills and assets within each segment (Shea and Roberts 2008). This also confirms the complex scheme of interactions between geographic location, price, and services (Urtasun

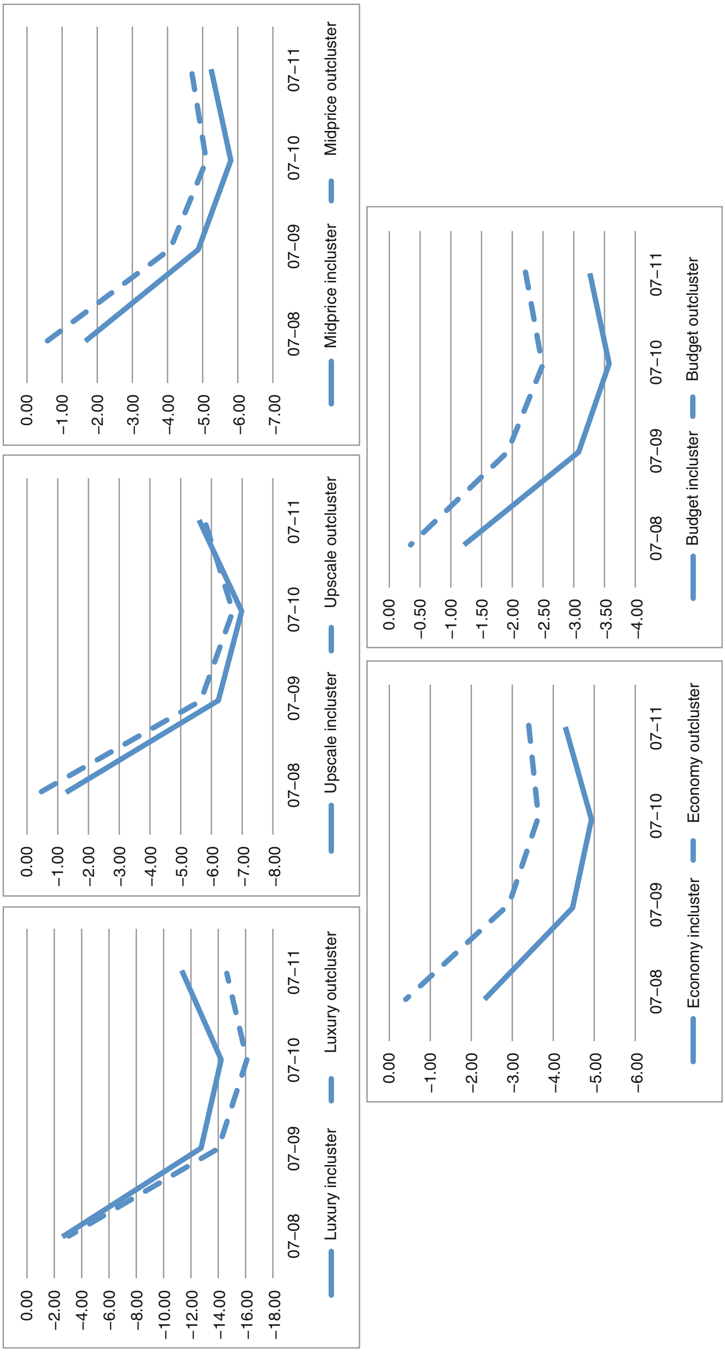

Fig. 2 RevPAR changes from 2007 through 2011 depending on the hotel category

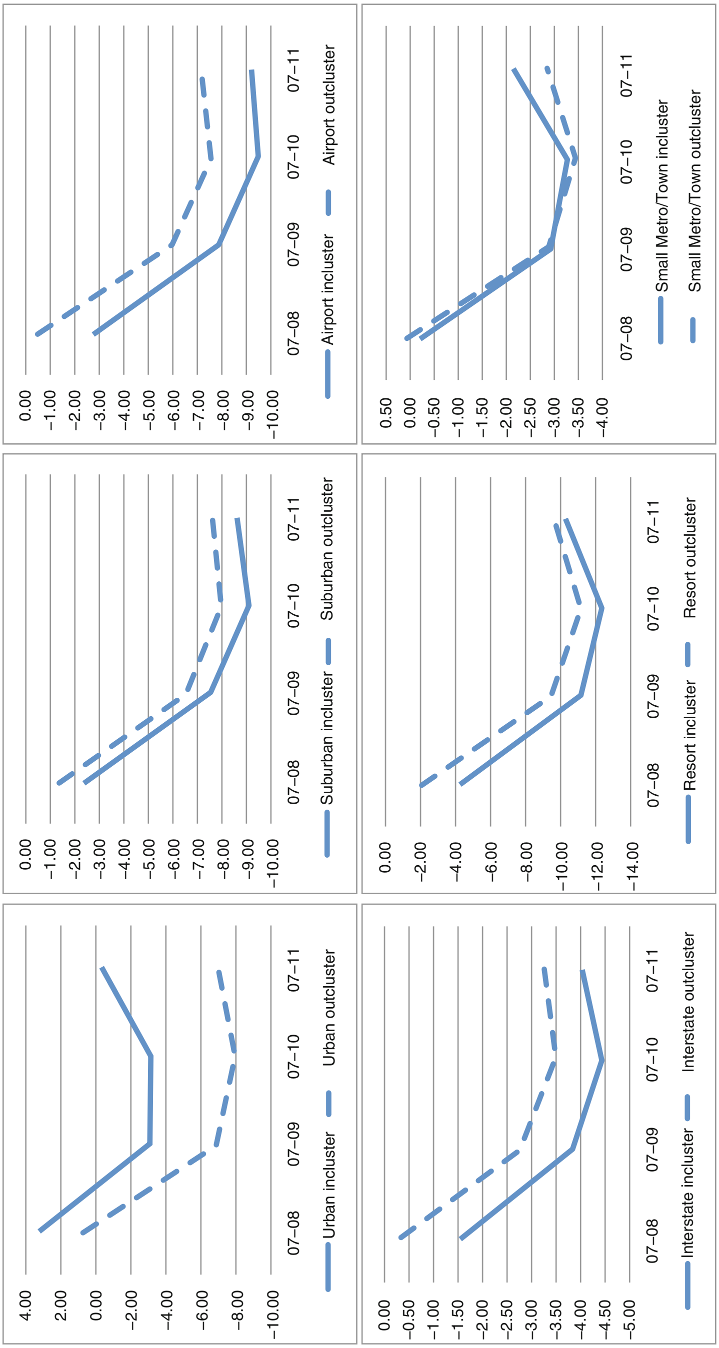

Fig. 3 RevPAR change from 2007 through 2011 depending on the hotel location

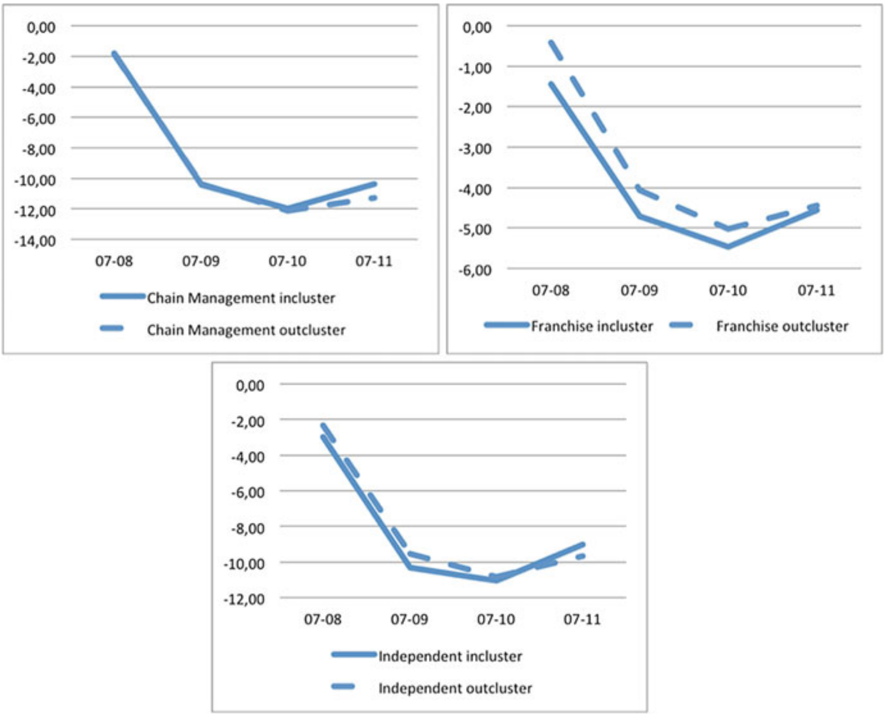

Fig. 4 RevPAR change from 2007 through 2011 depending on the hotel affiliation type

and Gutiérrez 2006). According to these authors, in an urban context, greater benefits can be found in geographic agglomerations of competitors with different services but greater costs, and benefits were found in geographic agglomerations with competitors with similarly priced hotels that would explain why luxury hotels, which are more differentiated, are able to get higher economic revenue inside a tourism cluster than those located outside. This segment has also been identified as the one with more possibilities to exploit the co-creation and customer engagement that could lead to an improved reorganisation of the value chain, with the creation of synergies (Chathoth et al. 2016).

Low-concentrated clusters seem to have better results than medium- or high-concentrated clusters. We think that this might be caused by market saturation. That is, heavily concentrated markets produce highly competitive environments; hence, pressure on prices (reflected in the ADR) or in volume (reflected in occupancy) may affect RevPAR.

Figures 2, 3 and 4 show accumulated RevPAR change from 2007 through 2011 for each level, location, and affiliation.

6 Conclusion, Limitations, and Further Research

Our analysis of economic indicators using the economic crisis as an initial point using an ES (event study) analysis shows mixed results. First, the only in-cluster group that is performing significantly better when analysing the property location is the urban group. Second, findings show that in-cluster luxury hotels perform much better than those located outside clusters, in line with previous studies that determined the importance of differentiation within a cluster (Freedman and Kosová 2012; Urtasun and Gutiérrez 2006; Canina et al. 2005) and the importance of heterogeneous performance within agglomeration domains (Chung and Kalnins 2001; Yang et al. 2012), also showing that luxury hotels have a higher ability to benefit from the agglomerations' externalities. Even if their prices are eroded easily, when competitors are co-located (Enz et al. 2008), they still seem to be more profitable. These results allow us to accept the third hypothesis that affirms property level influences the economic performance of hotels within a touristic cluster. These findings are consistent if we consider that usually luxury hotels are located in the city centre.

Third, there is an interesting conclusion showing that independent hotels perform better in clusters than outside clusters. This could be because in-cluster independent hotels have a more agile managerial structure and are able to make their own decisions that better allows them to react to the environment, and better benefit from agglomeration externalities, which reinforces previous findings (Chung and Kalnins 2001).

The ability of a destination to skip a decline phase can come by the ability of its hotels to take advantage of the externalities. This becomes especially important, on the one hand, for policymakers in charge of touristic promotion and, on the other hand (and becoming of particular importance), for hotel managers in setting their strategies and making their decisions. These results have important managerial implications, considering that the allocation decision is one of the most important. These localisations' economies have been minus-valued at the service sectors, albeit these advantages could be clearer in tourist clusters, where cooperation, partnerships, and existing networks in specialised destinations are sources of tourism innovation (Peters and Pikkemaat 2005).

Taking into account the possible cluster effect, or the importance of the destination, will not be enough; it is also important to consider the differentiation level of the property and property management. We can conclude that luxury and urban hotels are clearly benefitting from being allocated in a touristic cluster, especially if it is a low-concentrated touristic cluster.

That hotel managers should try not to allocate their properties in a highly concentrated cluster has also been clarified. Also facing an economic crisis, in-cluster hotels are in general performing better than out-cluster ones.

Albeit, our findings have a solid base, because we analysed more than 27,000 properties using different years' data; however, the study also has its limitations. First, we are not able to explain why against all forecasts, airport and suburban in-cluster hotels are performing worse than out-cluster ones; second, the period of time studied, from 2007 to 2010, may be biasing our results. To solve this, the study should be replicated in a period with more economic stability.

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The Story of Cluster as a Cross-Boundary Concept: From Local Development to Management Studies

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Abstract The chapter explores in an original manner the evolutionary trajectories of the cluster concept over time through the application of analytical tools coming from the realm of bibliometric analysis and social network analysis. In particular, we build on a previous work (Lazzeretti et al. J Econ Geogr 14(1), 21–43; 2014) to observe the evolution of the cluster literature alongside two main dimensions: (1) publication outlets and (2) paper keywords. Our analysis confirms the interdisciplinary character of the cluster concept, with the presence of publication outlets from different research fields. However, the contribution of management and innovation studies increases over time. The longitudinal analysis of the keywords confirms this trend and reveals that the cluster literature is evolving from economic and sociological-related issues to management-related topics, where innovation and firm performance are the leading issues.

Keywords Industrial cluster · Industrial district · Bibliometric analysis · Social network analysis · Keyword analysis

1 Introduction

The chapter contributes to previous work on the foundations and the development of the cluster concept by introducing a new perspective of analysis, which is oriented to pinpoint the thematic move from the origin to the last phases of development of a mature, well-known, and widespread concept such as that of cluster. The contribution, which is theoretically driven, explores in an original manner the evolutionary trajectories of the cluster concept over time through the application of analytical tools coming from the realm of bibliometric analysis and social network analysis. In

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particular, the empirical analysis of the relevant literature let us underline how the cluster research moved over time from clustering-related issues to firm management-related ones.

Other studies have applied these analytical tools to the study of evolution of the cluster concept (Cruz and Teixeira 2010; Lazzeretti et al. 2014; Hervas-Oliver et al. 2015). However, none of them have used keywords as tools to analyze the content of the literature and its evolution over time. This is what we do in this article, combining content analysis with bibliometric and social network analysis. The chapter builds on a previous work developed by the authors (Lazzeretti et al. 2014) and in particular on the original database that was built on that occasion, which included a set of 1586 articles on cluster research, collected by ISI–Thomson Reuters Web of Science database (henceforth, ISI), which have been published from 1989 to 2010 in 250 international scientific journals. From this database, we identified a number of founders of the cluster literature, i.e., articles upon which the cluster literature is based, and disseminators of the cluster concept, i.e., the most cited articles on cluster written in the overall period.

In order to give a comprehensive picture of the evolutionary trajectories of the concept, in this work we complement the existing dataset by adding the forward literature. In particular, by performing a forward citation analysis, we added the articles that cite all the previously identified founders of the cluster literature. The latter analysis is based on 8381 ISI articles, published in 829 journals.

We observe the evolution of the cluster literature alongside two main dimensions: (1) publication outlets and (2) paper keywords. These two are the most used tools to conduct bibliometric analysis. The analysis of paper keywords is performed both through the observation of most used keywords and through the analysis of clusters of keywords that are most frequently found together.

On the one hand, the analysis of publication outlets helps us in defining the general boundaries of the discipline. In this realm, we find out that, although the concept of cluster has fertilized many contributions that were published in the field of economic geography, most of the biggest contributors to the scientific debate on the subject belong to the fields of management and innovation. On the other hand, the analysis of paper keywords gives us a more fresh insight on the specific topic developed by the authors. We divided the forward citations in three periods: the first one corresponds to the 1990s, the second one corresponds to the 2000s, and the third and final one runs from 2010 to 2013. This latter analysis produces a hybrid picture, where new keywords emerge in the second period, which define the new trajectories of the concept. We find that the cluster literature is evolving from economic- and sociological-related issues to management-related topics, where innovation and firm performance are the leading issues.

The chapter develops as follows. Section 2 explains in detail the dataset we have used for our empirical analysis. Section 3 presents the main results of the analysis of publication outlets, while Sect. 4 deals with the analysis of the keywords used by the authors. By using some social network analysis tools, Sect. 5 presents an analysis on the clusters of keywords that are most frequently found together. Section 6 discusses the main results of our analysis on the evolution of the cluster literature and provides some concluding remarks.

2 Data and Methodology

The starting point of our analysis on the evolution of the cluster concept is represented by a previous work, done by the authors, which looked at the roots of the concept and identified a number of founders and disseminators of cluster literature. In order to identify these two different populations of articles, we referred to the ISI database.[1] In particular, after having performed an advanced search on "industrial district*" or "cluster*" as topic in ISI (only in some subsets of subject categories and only from 1989 to 2010)[2] and having excluded the intruders (e.g., articles in which the term "cluster" was referred to the cluster analysis technique), we obtained a database that included 1586 journal articles that have been published in 250 international journals. Then, we identified the most cited articles—46 papers that have collected at least 10 citations on average (by year)—which represent the "disseminators" of the cluster concept.

The founders of the cluster concept were identified on the basis of a backward citation analysis performed on the disseminators. The founders include the prominent works of Alfred Marshall (1920) and Michael Porter (1990, 1998) but also those of Giacomo Becattini (1990), Paul Krugman (1991), Allen Scott (1988), and Michael Storper (1997). Through the use of some social network analysis, we identified different scientific communities (ten communities) in which the founders can be grouped. These communities are meaningful groups of references that are connected by the presence of a theme, an author, a concept that is linked to the cluster concept, or—more often—the common membership to the same scientific area.

We have built on this existing database, as well as on our previous analysis, in order to look at the evolution of the cluster literature. Through a forward citation analysis on the founders, we have identified all ISI articles—written from 1985 to 2013—that cite these milestones of the cluster literature. In order to consider only the relevant literature, we have considered only the articles that cite more than one founder. Moreover, in order to maintain the interdisciplinary approach that characterizes this literature, we have included only the articles that cite founders belonging to more than one scientific community.

As a result, we obtained a database including 8381 ISI articles, published in 829 journals. In order to deepen our understanding of the evolution of the concept

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[1]The choice of ISI as the referring database was motivated by its widespread international use for rating the research output of scientists in every discipline. However, in Lazzeretti et al. (2014), we also acknowledge the limitations of such database for research purposes.

[2]As explained in detail in Lazzeretti et al. (2014), we chose to consider both the cluster and the industrial district, because these two concepts are strongly interconnected (see also McEvily and Zaheer 1999; Porter and Ketels 2009).

alongside new trajectories, we have performed a content analysis. In particular, we have collected the keywords used by the different authors to describe their articles (as reported by the ISI database) and we have analyzed their meaning and their evolution over time. The 8381 ISI articles we included in our database use 4820 keywords.

3 Analysis of Publication Outlets

In order to identify the main scientific fields in which the cluster literature develops, we observe the scientific journals in which the forward literature was published. The literature develops over a very high number of scientific journals (829 journals) and shows the typical structure of a long-tail distribution, with a small subset of journals that have published a very high number of articles and a very large portion of journals that rarely host articles on the topic (Fig. 1). Indeed, only about 7% of the observed journals publish at least one article per year on average (i.e., at least 29 items in 1985–2013). On the other hand, about 41% of the journals host only one contribution that can be considered related to the cluster literature.

The following Table 1 shows the top journals in which the forward literature has been published. Although some of the most relevant journals in the field of economic geography are in the list (*Regional Studies*, *Journal of Economic Geography*, *Economic Geography*, *European Planning Studies*), the largest part of articles is published in innovation or management journals such as *Research Policy*, *Strategic Management Journal*, *or International Journal of Technology Management*.

In order to analyze the time evolution of the forward literature, the following Table 2 splits the time period observed into two sub-periods (1985–1999 and 2000–2013) and lists the 15 top scientific journals in terms of number of articles published in each of the two periods. The management and innovation literatures dominate the scene in both periods. In particular, the management literature prevails in 1985–1999, while innovation studies become predominant in the second period. In 1985–1999 the list of most relevant outlets also includes economic and sociological journals, which however disappear in the second period.

Fig. 1 The long-tail distribution of the forward literature. Source: Authors' elaboration

Table 1 Most relevant scientific journals in the forward literature in terms of number of articles published (percentage on the total number of articles in the forward literature, 1985–2014)

Scientific journal	Pct of articles
Research Policy	373
Regional Studies	347
European Planning Studies	301
Strategic Management Journal	299
Environment and Planning A	188
Organization Science	164
International Journal of Technology Management	148
Technovation	139
Journal of Management Studies	135
Journal of International Business Studies	125
Journal of Economic Geography	114
Academy of Management Review	106
Urban Studies	104
Economic Geography	100

Source: Authors' elaboration

4 Content Analysis

In what follows we present the results of the content analysis on articles' keywords. We start our observation from the 1990s, because this is the period in which, after the publication of the famous contribution of Michael Porter (Porter 1990), the cluster concept emerged more clearly on the global scenario. At that time, the debate on the industrial district was already started (cfr. Becattini 1979), but the very end of the 1980s to early 1990s witnessed the first publications on the topic in international journals or volumes edited by international publishers (Brusco 1986; Becattini 1989, 1990; Bellandi 1989).

We divide now the period in three parts: the first one corresponds to the 1990s, the second one corresponds to the 2000s, and the third and final one runs from 2010 to 2013. Our analysis excludes the keywords that are present in all time periods, which evidently are not able to characterize a specific moment in time. Network is one example of such words. This keyword is not included in the list because—not surprisingly—it is one of the catchwords that are present along the whole period under observation. The following Table 3 presents the results of our analysis.

The first period is characterized by a series of keywords that focus on the flexibility issues. The debate on flexible specialization is the result of the reception of the book written by Piore and Sabel (1984), which raised new questions about the development model that, at that time, characterized the capitalist countries. Their contribution on post-Fordist models of production gave a strong impetus to the spread of the concept of industrial district. Following the authors, industrial districts should have been considered a building block for the creation of a sustainable growth path. Such pattern of growth would have been an alternative to mass

Table 2 Most relevant scientific journals in the forward literature in terms of number of articles published (first 15 journals, percentage on the total number of articles in the forward literature in the two periods 1985–1999 and 2000–2013)

Scientific journal	1985–1999	Scientific journal	2000–2013
Strategic Management Journal	5.4	*Research Policy*	4.7
Environment and Planning A	5.0	*Regional Studies*	4.2
Regional Studies	3.9	*European Planning Studies*	4.1
Academy of Management Review	3.3	*Strategic Management Journal*	3.3
Research Policy	3.1	*International Journal of Technology Management*	1.9
Administrative Science Quarterly	2.9	*Technovation*	1.9
Organization Science	2.9	*Environment and Planning A*	1.8
Economic Geography	2.5	*Organization Science*	1.8
Small Business Economics	1.9	*Journal of Management Studies*	1.6
Organization Studies	1.8	*Journal of Economic Geography*	1.6
American Journal of Sociology	1.5	*Journal of International Business Studies*	1.5
Cambridge Journal of Economics	1.5	*Entrepreneurship and Regional Development*	1.3
Urban Studies	1.5	*Industrial and Corporate Change*	1.2
Journal of Management Studies	1.4	*Urban Studies*	1.2
World Development	1.4	*Academy of Management Journal*	1.2

Source: Authors' elaboration

production, which in the mid-1980s was definitely in crisis. In their famous book, the authors discussed the fact that one of the district strengths was the flexibility of small enterprises located within its boundaries, as well as the flexibility of the district as a whole. It is known that such flexibility comes from the fact that the specialized competencies of the firms operating along the local value chains can be quickly assembled in a variable way in order to manufacture different products. This means that product differentiation and innovation, which were needed to compete after the crisis of the mass production system, were within the reach of the small firms of the industrial districts, more than of large and cumbersome corporations.

Keywords such as flexibility (on top of the list of most popular keywords), flexible accumulation, Fordism, post-Fordism, flexible specialization, and flexible production are related to this debate, which was very lively in these years (see also Storper and Christopherson 1987; Kenney and Florida 1988; Christopherson and Storper 1989; Storper and Harrison 1991; Hirst and Zeitlin 1997; Storper 1995; Sabel 1999).

Table 3 Keywords characterizing the periods 1990–1999, 2000–2009, 2010–2013

1990–1999		2000–2009		2010–2013	
Keyword	Freq (%)	Keyword	Freq (%)	Keyword	Freq (%)
Flexibility	1.07	Knowledge spillovers	0.77	Knowledge spillovers	1.17
Location	0.90	Patent citations	0.62	Knowledge transfer	0.95
Flexible accumulation	0.70	Proximity	0.62	Patent citations	0.86
Silicon Valley	0.65	Knowledge transfer	0.56	Structural holes	0.62
Growth dynamics	0.62	Tacit knowledge	0.53	Innovation systems	0.48
Embeddedness	0.62	Semiconductor industry	0.50	Weak ties	0.48
Social structure	0.62	Organizational knowledge	0.38	Buzz	0.46
Trust building	0.62	Innovation systems	0.33	Semiconductor industry	0.32
Collaborative behavior	0.59	Intellectual property	0.30	Exploration	0.28
Transaction cost approach	0.51	Heterogeneity	0.27	Organizational knowledge	0.28
Fordism	0.36	Structural holes	0.27	Start-ups	0.28
Post-Fordism	0.36	University-industry	0.27	Exploitation	0.27
Flexible specialization	0.34	Collective learning	0.24	Intellectual property	0.26
Flexible production	0.31	Foreign subsidiary	0.15	Pipelines	0.25
Institutions	0.25	Venture capitalists	0.15	Global production network	0.22

Source: Authors' elaboration

Another scholarly debate that characterizes the 1990s is about Silicon-like regional economies (or regional networks). The famous book written by AnnaLee Saxenian (1994) brings a growing interest in the origins and dynamics of production networks in Silicon Valley (see also Saxenian 1990, 1991 or the more recent Saxenian and Hsu 2001). Silicon Valley with its booming semiconductor industry becomes an example of how interfirm networks can support the technological dynamism of a region. The book of 1994 opens to the study of regional networks and how these can support the coevolution between firms social structures and local institutions. The keyword "Silicon Valley" is (obviously) directly related to this debate. Keywords such as social structures growth dynamics collaborative behavior embeddedness and institutions are also related to this debate.

The transaction costs approach is often used to explain the particular web of relationships that characterizes these local or regional networks (see Dei Ottati 1994, for the case of the industrial district). Hence, we found this term in the list of keywords that characterize the period. Part of the cluster literature that is published in these years—typically that in the field of geography—focuses on the topic of localization (location of firms and clusters).

In the decade 2000–2009, literature becomes increasingly focused on innovation. The most relevant keyword that characterizes the period is knowledge spillovers (together with absorptive capacity, which however is not included in Table 3, because it is very much diffused also in the other two periods), which becomes one of the key concepts to understand the atmosphere that characterizes innovation clusters (e.g., Audretsch and Feldman 2004; Bathelt et al. 2004; Dahl and Pedersen 2004; Audretsch and Lehmann 2005; Niosi and Zhegu 2005; Iammarino and McCann 2006). Connected to knowledge spillovers—and, in particular, to the empirical measurement of this concept—we also find the keyword "patent citations" (Jaffe and Trajtenberg 2002; Maurseth and Verspagen 2002; Thompson and Fox-Kean 2005).

Some keywords refer to the key concepts that characterize the studies on innovation in the 2000s. The first concept is the discovery of the role that territorial proximity can play in triggering innovation. Proximity refers to this concept, together with "tacit knowledge" and "collective learning." The debate on collective learning starts at the end of the previous decade (Capello 1999; Keeble et al. 1999) and continue in the 2000s by putting more emphasis on its consequences for endogenous development (see, for instance, Capello and Faggian 2005).

The second concept is that of innovation system (Carlsson et al. 2002) and particularly that of territorial innovation system (Lundvall et al. 2002; Cooke et al. 2004). Born in the previous decade, the concept of regional innovation system develops along the first half of the 2000s (Kaufmann and Tödtling 2000; Cooke 2001; Cooke et al. 2003; Asheim and Isaksen 2002; Asheim and Coenen 2005; Doloreux and Parto 2005; Belussi et al. 2010). This debate is intertwined in various ways with the one on technology transfer and university-industry relationships, which is the third key concept characterizing the decade (Acs et al. 2002). Keywords such as knowledge transfer, university-industry, intellectual property, and venture capitalists are related to this debate.

In this time period, keywords related to micro-level units of analysis—typically, the individual firm—enter the top list of the most popular keywords. Organizational knowledge is one of such keywords. Although the concept is defined in the previous decade, the related debate continues to develop in this period (Bollinger and Smith 2001; Tsoukas and Vladimirou 2001; Nonaka et al. 2006; Nonaka and Von Krogh 2009). Its presence in the list depends, on the one hand, by the fact that management scholars analyzing the individual organization are increasingly aware of the importance of the external environment to foster firm learning (innovation, development, etc.). On the other hand, scholars analyzing territorial systems (clusters, districts) show a greater sensitivity to the individual system components. Other firm-related keywords refer to the cross-fertilization between the studies on multinational firms and those on clusters. Keywords referred to studies on multinationals are also common in the previous decade, but during the 2000s their number and use increase.

The number of firm-related keywords included in the top list increases in the period 2010–2013. Indeed, keywords such as "organizational knowledge," "exploration," and "exploitation" either enter the top list or confirm their presence (Russo and Vurro 2010; Yang et al. 2010). Even scrolling down the ranking (not displayed here), we find many keywords related to knowledge management and the innovative capacity of the individual firm (e.g., "ambidexterity"). Keywords related to the meso-level studies on innovation and technology transfer ("knowledge spill-overs," "knowledge transfer," "patent citations," "structural holes," "innovation systems," weak ties," "buzz," and "pipelines") are however on top of the list.

5 Social Network Analysis

In order to identify some meaningful core themes that characterize the literature of the last 30 years, we used a mix of instruments coming from the fields of bibliometric analysis and social network analysis.

Using the tools of the social network analysis, we have built a network that ties together each article in our database with its keywords (two-mode network). Then, we have transformed it into a one-mode network made of keywords only. In particular, we have generated three networks related to the time periods considered before (1990–1999; 2000–2009; 2010–2013). After having removed the words "cluster" and "district" (and all their variations) and deleted all words that are used only once and couples of words that are found together only once (i.e., dyads linked by only one relation), we have obtained three networks including, respectively, 361, 835, and 1016 keywords. We then applied a clustering algorithm to identify meaningful combinations of keywords that are most frequently found together. In particular, we have implemented the island routine that is included in the Pajek software (Batagelj and Mrvar 1998; De Nooy et al. 2011), which identifies connected small subnetworks of a larger network with stronger internal cohesion than its neighborhood (namely, islands). Each node of the same island (each keyword, in our case) is linked with some other nodes in the same island through a relationship having a weight at least *t*.[3] As a result, we obtained 17 islands in the network 1990–1999, 33 islands in 2000–2009, and 43 islands in 2010–2013. Figures 2, 3 and 4 display only the largest islands we detected in the three networks.

These islands show a different aspect from the most cited keywords that are displayed in Table 2. Looking at the three networks, we can identify some islands of keywords, which do not necessarily include the most common keywords, that are mostly used jointly. Different islands are marked with different colors.

In all networks, islands include keywords that are characteristics of a management approach, together with keywords related to geography, economic geography,

[3]Note that the nodes that are included in an island can also be connected to other external nodes, which are not part of the same island. After several trials, we choose to identify islands in the range 3–20, which means that the minimum size of the island must be 3 nodes, while the maximum must be 20 nodes (keywords, in our case).

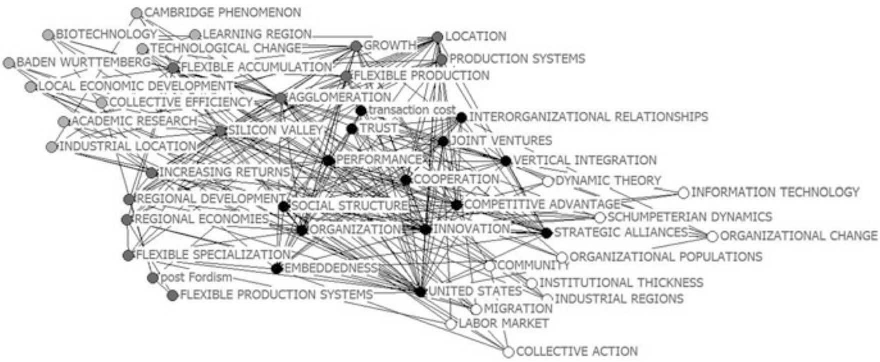

Fig. 2 Keywords' islands in the cluster literature in the time period 1990–1999. Note to figure: Only the four largest islands are displayed. Different islands are highlighted in different colors, from black to white. To make the image readable, the thickness of the lines that connect the nodes of the network is not highlighted (i.e., all the lines are set to the same minimum thickness of 1)

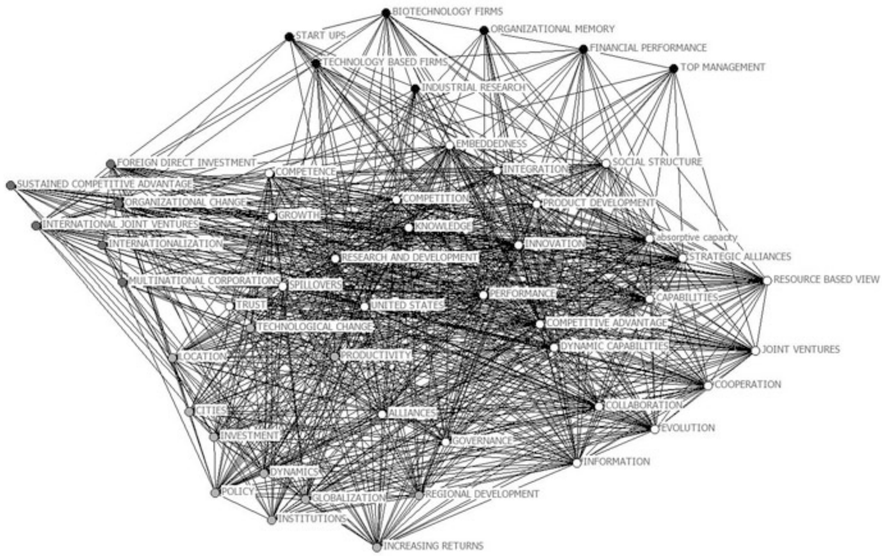

Fig. 3 Keywords' islands in the cluster literature in the time period 2000–2009. Note to figure: Only the four largest islands are displayed. Different islands are highlighted in different colors, from black to white. To make the image readable, the thickness of the lines that connect the nodes of the network is not highlighted (i.e., all the lines are set to the same minimum thickness of 1)

economics, or sociology approaches. Not surprisingly, the interdisciplinarity that characterizes the cluster literature is also reflected in the composition of the keywords' islands. The first part of Fig. 2, which is related to the first network (1990–1999), displays four main islands. The largest one, highlighted in black, is related to strategic alliances and networks in innovation, while the island highlighted

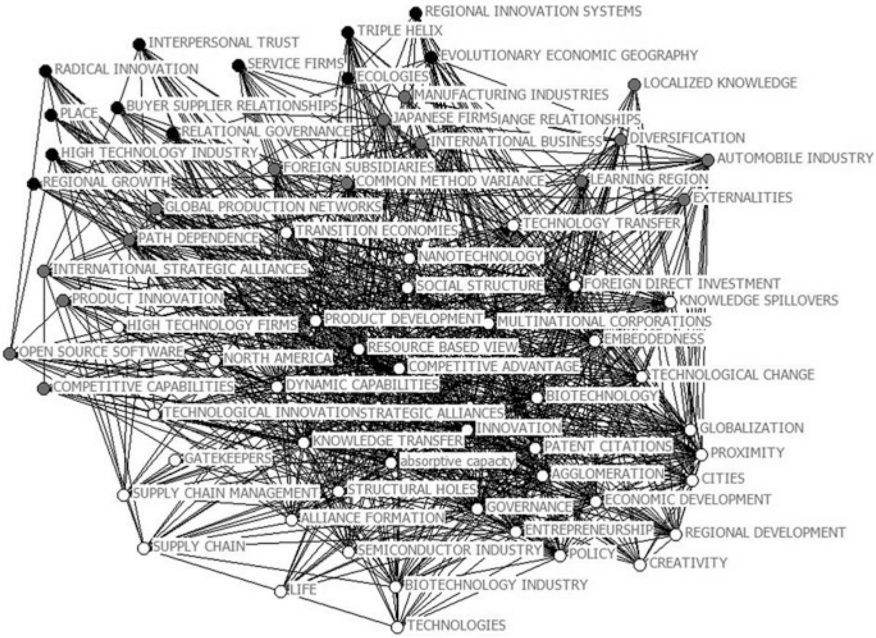

Fig. 4 Keywords' islands in the cluster literature in the time period 2010–2013. Note to figure: Only the three largest islands are displayed. Different islands are highlighted in different colors, from black to white. To make the image readable, the thickness of the lines that connect the nodes of the network is not highlighted (i.e., all the lines are set to the same minimum thickness of 1)

in white, refers to the analysis of different patterns of innovation in regions and clusters. Both islands mix keywords that refer to the single firm with others that refer to meso-level units of analysis. The debate on regional growth is at the center of the two remaining islands, with the first island (highlighted in light gray and located in the upper part of the graph) focusing on learning regions and the second (highlighted in dark gray and placed between the just-mentioned island and the one highlighted in black) focusing on flexible specialization.

The four islands that are highlighted in the second graph of Fig. 2 include keywords that refer, again, both to micro- and meso-level units of analysis. For an easy readability of the graph, the frequency with which these keywords are jointly cited is not highlighted in the picture. However, it is easy to note that in this second time period, there is a general increase in connections, which means that many of the keywords displayed in the graph are used jointly. The largest island (highlighted in white) and the island highlighted in black (on top of the graph) refer to innovation and organization studies. These islands mix firm- and cluster-level approaches. The island highlighted in dark gray (left-hand side of the graph) refers to international-ization and multinational companies and mostly adopts a micro-level approach. Finally, the island highlighted in light gray (bottom of the graph) refers to regional development and cities.

The mix between firm-level and cluster-level keywords is even more evident in the islands that are identified in the third part of Fig. 2, which is related to the network from 2010 to 2013. Innovation-related terms are dominant in the three clusters displayed, and organizational approaches, related to knowledge management, are scattered in these islands. The island highlighted in white includes keywords that focus on knowledge absorption from external sources. The island highlighted in gray focuses on international studies and on international strategic alliances in particular. The island highlighted in black is more focused on knowledge management. It includes keywords such as "knowledge-based theory," "knowledge management," and "organizational ambidexterity." However, it also includes meso-level keywords such as "regional growth" that are related to clusters, regions, or cities.

6 Conclusion

Based on a previous contribution of the authors, which identifies the founding fathers of the cluster concept, this chapter has discussed the most recent evolution of the cluster literature. In particular, combining content analysis with bibliometric and social network analysis, the paper analyzes the evolution, since the 1990s, of the cluster literature by focusing on the keywords used by the authors to describe their work. The use of this mix of tools adds some novelty to previous analyses on the evolution of the cluster literature. In particular, the analysis of keywords is particularly appropriate for the exploration of the content of the literature, which changes over time.

To perform our analysis, we have built an original database that includes the literature that cites the founding fathers of the cluster concept, and we have collected information in particular about the journals on which this forward literature is published and the keywords used in the various citing articles.

Our main findings can be summarized as follows. The previous work by Lazzeretti et al. (2014) shows that interdisciplinarity is a fundamental character of the cluster literature. The analysis of keywords developed in this chapter confirms this aspect. In fact, throughout the period observed, from the beginning of the 1990s to 2013, keywords that are related to meso-level analysis (cluster and district in the first place, but also city, region, or network) combine with keywords related to micro-level analysis (the single firm or some aggregation of firms). However, the analysis of the most cited keywords, which we carried out by considering the three periods 1990–1999, 2000–2009, and 2010–2013, shows that the most recent period has witnessed the diffusion of keywords that refer to the individual firm and particularly to the mechanisms that allow it to learn, innovate, and create value.

The second part of the analysis is related to the network we constructed starting from the information related to the connection between each article in our database and the keywords it identifies. After having applied some simple social network analysis tools, we identified some islands of keywords that are most frequently found together. This analysis confirms the trend described above. In fact, in all time networks (1990–1999, 2000–2009, and 2010–2013), clusters include keywords that are typical of a management approach, together with keywords related to geography, economic geography, economics, or sociology approaches. However, the mix between firm-level and cluster-level keywords is more evident in the clusters that are identified in the final time window (2010–2013), and it is testimony to the growing importance of firm-level analysis.

This trend can be explained by the presence of two main forces. On the one hand, management scholars analyzing the individual organization are increasingly aware of the importance of the external environment to foster learning (innovation, development, etc.) in firms. Therefore, over time, such scholars have become sensitive to the analysis of firms into contexts, and in particular in various types of meso-level contexts, such as the cluster (but also the city, the region, the network, etc.). On the other hand, scholars analyzing territorial systems (clusters, districts) progressively show a greater sensitivity to the individual system components. Indeed, the most recent literature on clusters recognizes that the full understanding of meso-level systems requires the understanding of the behavior of firms that populate, originate, and modify them with their strategic choices.

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How Local Knowledge Networks and Firm Internal Characteristics Evolve Across Time Inside Science Parks

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Abstract In this chapter we analyze how firms' characteristics, along with the network that each firm establishes, evolve through three different periods of time: incubation, growth, and maturity. We observe that as firms stay longer in the park, they have a higher number of direct relationships, and also these relationships tend to be stronger in terms of both frequency and friendship. Nevertheless, this higher level of interactions do not benefit firms in the same way, being the best period for improving innovation, the growth initial period, in which firms have between 3 and 6 years.

Keywords Network evolution · Knowledge exchange · Trust

1 Introduction

The increasingly competitive environment has led to organizational knowledge becoming a dominant source of innovation for firms. The creation, dissemination, and exploitation of knowledge has become critical in explaining competitiveness (Spender and Grant 1996). While some knowledge can be internally developed, it has been broadly demonstrated that a firm's innovative capacity depends strongly on external knowledge sources, such as relationships with universities, networking with competitors and colleagues, or customer involvement, among others (Boschma and Ter Wal 2007; Hansen et al. 2002; Zaheer and Bell 2005). Under the paradigm, the boundaries of the firm are porous, so firms can interact with their environment and either access external sources of information, ideas, and knowledge or create new combinations of knowledge (Expósito-Langa et al. 2011). It has been specially observed in high-technology industries, where firms can expand their learning

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capacity and improve their innovative capacity by combining external and internal knowledge.

In this context, science parks can be considered as an environment that is conducive to innovation as they provide the physical and social infrastructures that stimulate the creation and dissemination of new knowledge (Hansson et al. 2005). In particular, science parks encourage partnerships between the universities, the firms, and the management of park itself that improve their learning abilities and capacity for innovation (McAdam and McAdam 2008). The development of knowledge networks inside parks among these different agents has been proved to be particularly important for a firm's innovative capacity (Chan and Lau 2005; Löfsten and Lindelöf 2005).

However, there is little research about how these geographically bounded networks created inside park evolve across time and, in particular, how firms and support institutions foster a nurturing environment for new business start-ups but also lead to the subsequent development of growth-oriented firms. Local knowledge generated collectively tends to evolve over the time a firm remains in the park, so the benefits of the park are highly correlated to the evolution of the local network among colocated firms, as well as the internal characteristics of the firms involved (Ahuja et al. 2012; Phelps et al. 2012).

So, some parks launch incubation programs where firms can only take part for two or three years, it being considered that firms should graduate after that period. Under this approach, the park helps its firms gaining access to marketing and technical and managerial knowledge, as well as many other resources, but once firms learn how to successfully commercialize an innovation, they must leave (Allen and Mccluskey 1990; Rothaermel and Thursby 2005). Conversely, other parks allow firms to stay for as many years as they wish, using the argument that they can benefit from the local network during their long stay. However, there are certain doubts about how long a firm should stay in a park, receiving support and enjoying of local knowledge, as there could be a limit to benefit from local innovation (Clarysse et al. 2005).

The objective of this research is to analyze the role of the science parks as knowledge enablers across time, evaluating both the evolution of the internal characteristics of the firms and the network locally developed. We mainly adopt an evolutionary perspective (Balland 2012), in which network changes are analyzed under the light of network structural mechanisms (endogenous forces) (Powell et al. 1996; Soda et al. 2004) and firm-level behavior (Ahuja et al. 2012).

Empirical evidence has been gathered in Madrid Science Park, Spain. The aim of the Madrid Science Park is to promote research, development, and innovation, running a business development unit designed to support the creation and development of technology-based businesses, as well as to transfer knowledge and technology, and technology development units, which provide high-level scientific services to public and private research groups. There are no exit policies, which allow us to obtain information about firms in different periods of time, from those that has just established to those that had been more than 10 years established there. Moreover, firms have entered in the park in different periods of their development; almost 40% of the firms entered in the park when they had 5 or more years since their foundation.

This variability in their age of entrance in the park allow us to better understand the effect of the time in the park, without being so influenced by the natural growth of the firm from youth to maturity.

2 Local Knowledge Inside the Park and Time

2.1 Knowledge Networks Inside Parks

In understanding how science parks can promote knowledge flows and innovation, it is necessary to firstly consider the geographic concentration of firms and institutions that foster knowledge externalities. These localized knowledge externalities are created by informal relationships and face-to-face interactions: firms and other institutions can establish relationships, providing each other with personal contacts and technical advice (Bakouros et al. 2002; Löfsten and Lindelöf 2005; Mian 1996). According to this view, informal contacts allow knowledge to be shared between park members, while outsiders are excluded, since they are not in the local community (Vedovello 1997).

Nevertheless, the physical concentration of firms from the same sector is not enough to explain strong local innovation, and it is also necessary to consider institutional, cognitive, and social proximity (Boschma 2005). Compared to other agglomerated spaces, inside science park firms are not assumed to have basic common knowledge, language, and procedures (Díez-Vial and Montoro-Sánchez 2014). In this sense, inside park firms do not have to share the same industry, so they may lack of similar background. In this context, the entrepreneurial orientation can be considered a key element which helps to develop similar routines and practices and managerial philosophies, knowledge bases, and firm behaviors (Carayannis et al. 2006; Walter et al. 2006).

Moreover, this regional collective learning is based on basic common knowledge, language, and procedures among proximate firms as well as on relationships based on trust and reciprocity that facilitate mutual understanding and communication (Lawson et al. 1999). In science parks, three main relationships can be identified: those among colocated firms, those related to universities or any other higher education institutes, and those promoted by the park's management team. Inside parks, this reciprocity and trust among colocated firms do not evolve in the same way as firms are not assumed to be for long periods of time, being observed that firms tend to be reluctant to share information and ideas with other colocated firms or local institutions (Bakouros et al. 2002; Westhead and Batstone 1998b).

The university-firm relationship has been the most extensively researched topic, as most of the science parks were created with the objective of transferring technology from universities to firms (Quintas et al. 1992; Westhead and Batstone 1998b). In the case of firms located in science parks, the empirical evidence tends to confirm a higher level of interaction between firms in the park and the universities compared with firms outside the park (Felsenstein 1994). However, it has frequently been observed that these local interactions between firms and universities to be successful need either the development of personal and informal interactions (Bakouros et al. 2002; Colombo and Delmastro 2002; Vedovello 1997) or previous experience in dealing with scientific knowledge (Cohen et al. 2002; Díez-Vial and Fernandez-Olmos 2014).

Another kind of relationship, inside the park, relates to a park's management team. The management team may act as a bridging institution, providing firms with technical and business services and connecting outside agents to the local network. It is the function of being actively involved in the transfer of technology and business skills, as well as training for firms (Chan and Lau 2005; Westhead and Batstone 1998b). Moreover, there is an extensive network of ties with firms within the park and external agents. As a result, firms that establish links with the park can enjoy the knowledge spillovers available from all these sources (McEvily and Zaheer 1999).

But along with the source of the knowledge, recent contributions on the transfer and creation of local knowledge have shifted their attention to the characteristics of each firm (Morrison and Rabellotti 2009; Ter Wal and Boschma 2009). Inside a cluster, each firm establishes its relationships with others, and differences emerge between one firm and another in the knowledge externalities they can enjoy but also they can provide (Shaver and Flyer 2000). As a result, the internal characteristics that firms have inside the local network play a fundamental role in the creation and diffusion of knowledge and in local learning dynamics (Hervás-Oliver and Albors-Garrigós 2007). Knowledge is only available to firms that establish ties with other firms and institutions inside the local network. However, they also need to have the internal capacity to absorb this knowledge contributing to the development of local knowledge spillovers. In this more selective approach, formal relationships with partners and providers, but also informal interactions based on friendship and professional encounters, might function as channels through which knowledge is exchanged (Eisingerich et al. 2010; Owen-Smith and Powell 2004).

2.2 *The Role of Time on the Knowledge Network of the Park*

From a dynamic perspective, it has been observed that networks evolve over time and that this evolution is determined by a path-dependent process, as previous links condition the development of future ones (Balland et al. 2016). In particular, the formation of new relationships inside a network tends to follow a preferential attachment logic which reflects the tendency of firms with a central position to become more central over time, attracting new firms to their direct network (Powell et al. 2005).

A central position in the network implies that firms have many direct contacts with whom to exchange knowledge and access to a broader range of technical, managerial, and marketing knowledge, so they can complement their own knowledge and experience with that of their connected firms (Powell et al. 1996). Firms in central positions also tend to generate more visibility, status, and power, inside the network, which makes it easier for them to obtain institutional support and resources such as money, technology, machinery, or public funds (Gulati and Gargiulo 1999). When a new firm enters the park, it tends to establish links with the firms already located there, ideally with firms in central positions inside the network. If firms increase their direct relationships, they will benefit from moving into more central positions or being able to consolidate them (Powell et al. 2005).

Moreover, as firms increase the time they have spent in the park, they not only increase the number of relationships but also tend to reinforce these relationships by increasing the level of trust, commitment, and a certain emotional attachment (Ahuja et al. 2012). Firms need time to increase the strength of their relationships. Following Gulati (1995), firms repeating interactions with other colocated firms tend to develop trust, and this induces them to behave loyally, therefore reducing the mutual fear that others will act opportunistically. In this sense, it has been observed that networks tend to evolve toward triadic closure structures, where the main actors are all connected (Balland et al. 2016). Firms tend to reinforce their local relationships with frequent visits to and meetings with other firms, or informal encounters, and with personal proximity, which increases the willingness of firms to share knowledge (Molina-Morales and Martínez-Fernández 2009). In this environment, the risk of opportunism is reduced, firms tend to find more opportunities and time for knowledge transfer, and there is a feeling of reliability and positive expectations about future relations (Levin and Cross 2004; Phelps et al. 2012).

Nevertheless, the evolution of the network not only depends on endogenous factors but also on exogenous ones, as it is the behavior of the firms and institutions that configure the network. In particular, firms' characteristics and the differences among them have an impact on the evolution of local networks and facilitate or not the creation and development of local externalities inside the park (Brass et al. 2004; Demirkan and Demirkan 2012). It has been broadly considered that better firms would contribute most to create local externalities, while worse firms would benefit most (McEvily and Zaheer 1999; Shaver and Flyer 2000). These firms' characteristics also affect their willingness and involvement in the local network. Often, what is best for the network is best also for the firm (Morrison and Rabellotti 2009). This is the case of internal R&D investments of the firms locally involved, or their innovative capacity, that conditionate both the firms' capacity to absorb external knowledge and their contribution to develop a valuable local knowledge network.

R&D investments, firms' capacity to develop new products and process, and entrepreneurial orientation contribute to increasing a firm's capacity to recognize and assimilate external knowledge from the local network. As firms learn from their own R&D investments, and previous innovative experiences, they also develop their ability to understand external knowledge developed in the park (Cassiman and Veugelers 2006; Löfsten and Lindelöf 2005). Nevertheless, firms can develop their absorptive capacity if there is first a knowledge network available. In this sense, it is necessary to consider not only each firm's R&D and innovative capacity but also the R&D and innovative capacity of the other firms. That is, as firms invest in improving their own innovative capacity, firms from the network do it too (Lee et al. 2001). Additionally, the ability to transform in-park knowledge into profitable products and services depends, among other capabilities, on the capacity of the entrepreneur to identify, assimilate, and exploit opportunities arising from that knowledge, or, in other words, from their entrepreneurial capacity (Clarysse et al. 2005; Gedajlovic et al. 2013). So firms who are better able to recognize opportunities, and have extensive relationship experience, will have a greater entrepreneurial capacity to identify, understand, capture, and assimilate these local knowledge flows embedded in their network. As firms spend more time in the park, with other firms that are also investing in their R&D and innovative capacity, they would all benefit from the presence of high local innovators (Canina et al. 2005; Shaver and Flyer 2000). As a consequence, time would have a positive effect on firms' innovations, as long as the firms that are also in the park are investing in creating new products or processes.

3 The Science Park of Madrid: A Case Study

We study knowledge flows and firms' characteristics in the context of the Madrid Science Park, Spain, (*Parque Científico de Madrid*, PCM). The Madrid Science Park is a nonprofit foundation created in 2001 by the Autonomous University of Madrid and the Complutense University of Madrid. To obtain the data, we gathered information using structured interviews with managers at firms located in the park. The number of firms established and operating during this period was 94. We obtained complete information about our variables from 76 firms, representing 81% of the total information about the network. In any case, all relevant actors were interviewed and non-response bias was controlled.

3.1 Time in the Park

In part due to this terminological confusion about parks—research park, technology park, innovation center, science park incubator, etc. (Löfsten and Lindelöf 2005)—and variety of objectives that each one establish (Westhead and Batstone 1998a, b), it is not easy to identify relevant time frames that can take into account the expected evolution of firms inside parks. In this sense, this paper contributes by identifying relevant time frames for the evolution of the network inside parks.

For instance, many parks are mainly incubators, which are designed to allow a short stay of the new ventures. Incubation periods are expected to be short; after then firms are given an incentive to leave through exit graduation programs or exit policies that encourage them to move away from the incubators (Allen and Mccluskey 1990; Clarysse et al. 2005).

Nevertheless, most science parks are not only incubators but also facilitators of business development, so there is no exit policy and firms can remain in the park as long as they consider it beneficial to their business. In fact, Rothaermel and Thursby (2005) have found that firms staying longer in an incubator tend to generate significantly higher revenues. In the case of Spanish science parks, and following the definition of the Spanish Science and Technology Parks Association (*Asociación de Parques Científicos y Tecnológicos de España*, APTE), science parks are projects generally associated with a physical space that (1) maintains formal and operational links with universities, research centers, and other higher education institutions; (2) is designed to encourage the formation and growth of knowledge-based companies; and (3) has a stable management that promotes technology transfer and innovation among businesses and organizations using the park.

Taking into account these considerations and following to Rothaermel and Thursby (2005), in this study we have established three broad time frames: (1) from 0 to less than 3 years in the park, (2) 3 to 6 years, and (3) more than 6 years. The first period, from 0 to less than 3 years in the park, can be considered an incubation period, as firms have just arrived in the park, and they are generally trying to commercialize new products. The length established for this first incubation period is a conservative estimate, as most firms are expected to complete this stage in at most 2 years, and firms in incubators not graduating in 2 years can even be considered a failure. After it, we have split the post-incubator stage into two periods, establishing the sixth year as the cutoff point for differentiating them: the growth period (3 to 6 years), during which in theory firms tend to develop new local relationships and consolidate the existing ones, and the maturity period (more than 6 years), when firms have extensive experience in the local network as well as in launching new products in the market.

3.2 Firms' Characteristics

We have evaluated the characteristics of the firm first in terms of innovative capacity. We have measured the innovative capacity of firms by their capacity to creating and introducing new products or services and to adopting new technologies (Zaheer and Bell 2005). More precisely, following the Community Innovation Survey, we have measured innovation as the launch of new products or services that are new to the firm and new products or services that are not only new for the firm but also for the market. Similarly, we have measured innovation in processes for manufacturing or providing these products and services, which are new for the firm, called process innovation. We also have measured R&D investments to take into account not only firms' internal R&D investment but also their absorptive capacity, based on the assumption that existing knowledge influences their ability to understand and integrate new knowledge (Cassiman and Veugelers 2006).

As it can be observed in Table 1, firms tend to be more innovative in the growth stage, when firms have spent between 3 and 6 years in the park. Firms develop more products, new for the firm or also new to the market, while also they introduce new processes in this intermediate stage. In a similar way, firms invest more on R&D in this second stage. Comparing the incubation period (less than 3 years) with the growth period (3–6 years), we observe that firms increase in all these measurements, as expected. As firms consolidate their activities in the industry, they tend to invest

Table 1 Firms' characteristics

Variables	Time in the park			
	Total	Incubation (<*3 years*)	Growth (*3–6 years*)	Maturity (>*6 years*)
Radical product innovation				
Mean	4.026	3.535	5.545	1.6
Median	2	1	2	2
Std. dev.	12.007	6.131	17.318	1.454
Incremental product innovation				
Mean	9	7.857	12.545	3.333
Median	4	4	3	4
Std. dev.	24.001	12.231	34.520	2.663
Process innovation				
Mean	1.052	1.071	1.212	0.666
Median	0	0	0	0
Std. dev.	2.371	2.478	2.701	1.175
R&D expenditures				
Mean	237,622.6	67,664.29	366,288.3	291,083.3
Median	65,000	15,300	97,250	90,000
Std. dev.	625,318.1	117,301.7	883,759.7	405,224.4
Entrepreneurial orientation				
Mean	5.622	5.854	5.189	4.75
Median	5.888	6.166	5.25	4.75
Std. dev.	1.203	1.569	1.525	1.666
N	76	28	33	15

on new R&D investments and also are able to successfully commercialize their products and introduce new procedures. Nevertheless, when firms reach a maturity stage (they spend more than 6 years in the park), these variables are reduced.

These data offer interesting results for the length of stay of a firm inside a park and how this may affect the development of a valuable knowledge network. In early stages, firms are taking important investments that can contribute both to transfer valuable knowledge among firms inside the park and to better understand the knowledge provided by others. Nevertheless, networks among firms that have spent a long period in the park seem to be less conducive to create local knowledge spillovers.

In Table 1 we also present the evolution of the entrepreneurial orientation of firms across time in the park. What it can be observed is that firms just arrived to the park have a slighter lower entrepreneurial orientation than those in the growth stage, but in the mature stage, this level is lowest. Again, these results may indicate that after a long period in the park, firms are less proactive to identify, understand, capture, and assimilate these local knowledge flows embedded in their network, because their skill in identifying new business opportunities, their ambition, and risk-taking propensity tend to be lower.

3.3 Network Characteristics

In this research we measure the knowledge network using a widely used methodology: social network analysis (SNA) (Borgatti et al. 2002). SNA measures knowledge flows among firms, as well as different aspects of the one-to-one relationships that firms establish with different agents. These kinds of relational data were collected through a "roster recall" method: each firm was presented with a complete list (roster) of the other firms and institutions in the science park, and they were asked about their relationship with each other (Giuliani and Bell 2005; Ter Wal and Boschma 2009). As a consequence, we measured each variable by creating a matrix in which each cell contains information about the relationship between each pair of organizations. In our research we have information for 76 firms, but these firms have developed links with other firms surveyed but providing incomplete data (2 firms) with firms not surveyed (41) and with 9 institutions. As a consequence, for each variable we construct a 128 $\times$ 128 matrix where cell *ij* represents any characteristic of the relationship between organization *i* and organization *j*.

To measure knowledge sharing among organizations in the science park, and based on previous literature (Bell and Zaheer 2007; Boschma and Ter Wal 2007; Giuliani and Bell 2005; Hansen 1999; McEvily and Zaheer 1999; Molina-Morales and Expósito-langa 2012; Morrison 2008), we asked each manager to indicate the organizations from which they had received different kinds of knowledge over the last 2 years: "From which of the local organizations mentioned in the roster have you received technical knowledge such as advice about new production processes, product development, or more efficient machinery?" (0, no knowledge exchange; 1, very low intensity and frequency; to 7, very high intensity and frequency).

In Table 2 we present the main data about the evolution of each firm direct network, according with the time they have spent in the park. First, we have measured the degree, which measures the number of direct knowledge linkages that each node has with others in the network. Also, we have measured betweenness, which is the extent to which a particular organization lies between the various other organizations. It evaluates the role that firms may play as "broker," connecting different colocated firms in the science park (Chan and Liebowitz 2006). In this sense, betweenness takes into account all the relationships created inside the park and not only those directly established by each firm. With these two measures, degree and betweenness, we try to understand the position of the firm simply in terms of the structure of the network, without considering the type of relationships (Ahuja 2000; Freeman 1979).

The results of these variables indicate that as firms spend more time in the park, they develop a higher number of direct relationships: firms begin in the park with 4.035 relationships, evolve to 6.181 in the growth one, and after 6 years they have 6.866. Firms prefer to establish relationships with firms that have already built relationships with many others. In doing so, they can benefit from the higher status and power of those with many connections. Nevertheless, betweenness does not behave in the same way: it takes a value of 4.065 in the incubation stage, increases to

Table 2 Network Characteristics

Variables	Time in the park			
	Total	Incubation (<*3 years*)	Growth (*3–6 years*)	Maturity (>*6 years*)
Degree-direct relations				
Mean	5.526	4.035	6.181	6.866
Median	5	4	6	7
Std. dev.	3.594	2.741	3.273	4.778
Betweenness				
Mean	7.217	4.065	10.217	6.5
Median	4	2	6	4
Std. dev.	9.845	6.774	12.237	6.842
Strength tie				
Mean	4.471	3.828	4.859	4.819
Median	4.350	3.342	4.469	5.375
Std. dev.	2.578	2.816	2.424	2.362
Diversity of activities				
Mean	0.404	0.173	0.298	0.311
Median	0.5	0	0.375	0.375
Std. dev.	0.277	0.224	0.250	0.299
N	76	28	33	15

10.217 in the growth stage, and finally drops to 6.5 in the maturity stage. It is in the growth stage that firms have a more active role as broker in the local network. It seems as if the number of direct relationships increases, but its capacity to control and connect firms does not evolve in the same way.

To measure the relational aspect of the local network, we measure the strength of these knowledge relationships inside the science park. Following previous studies, we measure the strength of the relationships by considering the frequency of the interaction among firms and their degree of friendship (Hansen 1999; Reagans and Mcevily 2003). In particular we asked them the two following questions: “How close/friendly do you feel to the organizations mentioned in the roster?” (7 Likert scale) and “How frequently do you have contact with the organizations mentioned in the roster (conferences, informal encounters in meetings, formal or commercial relations, etc.)” (7 Likert scale). Once we calculated these data for each node, we calculate the mean value of each of these variables, dividing by the number of knowledge relationships that the firm has developed. In doing so, we try to measure the strength of each relationship, avoiding that the higher the number of relationships, the higher will be the strength of them. As expected, as firms spend more time in the park, the strength of their relationship tends to increase.

Finally, we measure the diversity in the ego network of each firm, in relation to the industries involved. Inside the science park, firms can undertake either of these activities: information technology and communication, environment and renewable energy, life sciences and chemical, nanotechnology, new materials and engineering, and other sectors and support services. Measuring these data for each firm, we calculate the degree of diversity in the ego network of each firm. We followed the heterogeneity measurement of Blau, as follows:

$$H = 1 - \sum_k P_K^2$$

where P_k gives the proportion of alters that fall in each activity K.

We observed that the diversity tends to increase in the mean value across time, but in terms of mean value, there is the same level of diversity in the growth and in the mature stages. We have included those variables because it is considered that a certain degree of diversity is positive, as a source of new ideas and technologies (Boschma and Iammarino 2009). Firms that come from different knowledge bases can widen one's perspective, enhancing creative thinking and providing opportunities for new combinations of knowledge across various knowledge domains (Wuyts and Dutta 2014). Nevertheless, in the case of science parks, the benefits of diversity seem to be lower than specialization. Differently from what occurs in clusters, in science parks host firms belong to different industries, with whom they do not necessarily have commercial relationships or that are competitors. Inside park firms are usually highly innovative and in many cases they are developing a new product or a new process, having a high entrepreneurial perspective. In this condition, firms that are linked with their local partners, within their same activity, can benefit from sharing investments and sophisticated equipment (Mian 1996). Technology-intensive industries are heavily reliant on R&D resources, and this dependence fosters a mutual exchange of knowledge.

Also, a high specialization of relationships inside the park fosters the development of an accumulated sector-specific knowledge that can help firms to make better decisions and to better estimate the innovative potential of new products and ideas (Grimaldi and Grandi 2005; Schwartz and Hornych 2008). In this sense, firms need a certain overlap of competencies, markets, and knowledge, to be able to incorporate new knowledge. Firms need a mutual understanding to absorb knowledge from others, in order to recognize, assimilate, and exploit it, with the goal of creating new products or processes (Cohen and Levinthal 1990).

4 Conclusions and Implications

In this research we have taken into account both firms' characteristics and the network structure that each firm established across three different periods of time: incubation, when the firm has spent less than 3 years in the park; growth stage, when the firm has stayed between 3 and 6 years; and maturity that includes firms that have spent more than 6 years in the park. Firms' characteristics are measured in terms of R&D expenditures, innovative capacity, and entrepreneurial orientation. Except for entrepreneurial orientation, in all cases firms that are in the growth stages present the highest values of these variables. Taking into account these data, a first implication for managers can be identified: the best firms to establish a network inside a park are those that have been there between 3 and 6 years. These are the firms that can contribute most to develop local knowledge spillovers that would benefit other firms.

When considering the network characteristics, we observe that firms with longer stages have a higher number of direct relationships, and also these relationships tend to be stronger in terms of both frequency and friendship. But firms develop their highest broker position in the growth stage. It seems that, again, firms in the growth stage are the best to establish relationships with others: they not only are better internally but also enjoy of a brokerage position that save time and efforts. Nevertheless, it could be considered that firms in the mature stage also benefit from a friendlier environment that foster mutual trust and the exchange of ideas. Also, since firms in mature stages have more direct contacts with firms belonging to different industries, they may develop a variety of ideas, information, and contacts that can help firms in improving their own innovative capacity.

There is also a clear recommendation for both managers and policy makers: after 6 years the benefits of belonging to the park are harder to be identified. Firms in mature stages have a lower capacity to innovate and entrepreneurial orientation. Belonging to the park provides several benefits for firms such as sharing machinery, procedures, and installations or improving their legitimacy. But above them all, locations inside science parks have recently been valued for giving access to valuable sources of knowledge. In this research we have focused on the knowledge network internally developed, using as a unit of analysis the firm and its local network. Future research could take into account the firms' ego network, studying its implications for both managers and policy makers.

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The Role of Leading Firms in Explaining Evolutionary Paths of Growth: Italian and Turkish Clusters on the Move

F. Belussi and A. Caloffi

Abstract This chapter presents an analysis of the long-term development of the footwear industry in Italy and Turkey, focusing in particular on their main industrial districts/cluster: one in Italy and three in Turkey. Our research contributes to the reflection on the evolving relationship between history-dependent localisation externalities and firm performances. Agglomeration benefits do exist in the various stages of the cluster life cycle. However, not all firms benefit equally from being in a cluster, and not all firms show an accelerated pattern of growth after being located in a cluster. We found that after the take-off and the cluster's emergence, the dynamics of clusters is driven by the ability of some leading firms to connect the cluster (and its internal supply chains) to external markets and to global knowledge sources.

Keywords Clusters · Evolution · Firm performance · Turkey

1 Introduction

This chapter presents an analysis of the long-term development of the footwear industry in Italy and Turkey,[1] focusing in particular on their main industrial districts/ clusters[2] (one in Italy and three in Turkey). Our research contributes to the reflection on the evolving relationship between history-dependent localisation externalities and firm performances. Agglomeration benefits do exist in the various stages of the

[1]The analysis presented in this chapter is based on the EU-sponsored ShoeColl project "Improving the shoe industry by means of the clustering method in order to gain the competitive capacity in the international market" 2010–2013. The project was designed to analyse the Turkish footwear industry and to provide policy suggestions for its improvement, also by comparing it with the Italian footwear clusters and creating linkages between Italian and Turkish cluster agents.

[2]In this chapter the terms industrial district and cluster are used as synonyms. A rich discussion on this issue can be found in Belussi (1996, 2015).

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cluster life cycle (Belussi and Sedita 2009). However, not all firms benefit equally from being in a cluster, and not all firms show an accelerated pattern of growth after being located in a cluster (e.g. Baum and Haveman 1997; Shaver and Flyer 2000; Chung and Kalnins 2001; Belussi 2006; McCann and Folta 2011). During cluster emergence (and initial development), there are visible benefits (Menzel and Fornahl 2009; Ter Wal and Boschma 2011) arising from agglomeration, such as the presence of a specialised labour market and the formation of a district atmosphere characterised by the circulation of ideas among entrepreneurs, as described by Marshall (1920). Whereas, during the consolidation phase, cluster firms exhibit an accelerated pattern of cumulative knowledge growth and a development of competencies, supporting the numerical extension of the local industrial structure formed by many small- and medium-large firms, inserted in a local net of flexible production processes (Belussi and Pilotti 2002, 2011). The subsequent stage of cluster development is driven by the ability of some leading firms to connect the cluster (and its internal supply chains) to external markets and to global knowledge sources (Giblin and Ryan 2015; Hervas-Oliver and Albors-Garrigos 2014; Belussi and De Propris 2014; Belussi 2015). This general evolutionary pattern was confirmed by our comparative analysis on Italian and Turkish clusters. In fact, as shown by our analysis, clusters that evolve over time, such as Istanbul and Montebelluna, are characterised by the presence of leading firms (in some cases MNEs with local origin) playing a connecting role and becoming a bridge between different clusters in different countries (Hervas-Oliver and Boix-Domenech 2013; Sedita et al. 2013; Narula 2014). Instead, clusters trapped in the early stages of their development do not see the emergence of any leading firms nor the entry through external MNEs. Also due to this absence, they develop weak connections with external markets and knowledge sources.

In particular, our empirical analysis compared three emerging or recently developed footwear clusters localised in Turkey—namely, Konya, Izmir and Istanbul—with a mature footwear cluster localised in the region of Veneto in the northeast of Italy, near Treviso and Venice: the Montebelluna sportswear cluster. Apart from the development stage, the four clusters differ in terms of the economic external environment in which they are situated (mature vs. emerging fast-growing countries), countries-specific institutions which characterise the four clusters (among which the regulations on labour and environmental protection), innovation intensity (high innovative clusters vs. imitative clusters) and the political framework in which the clusters are inserted (free market policies vs. defensive barriers to import policies). However, the clusters have some important similarities. They emerged in a similar way drawing on a core of historical craft traditions and have experienced similar early development stages, based on the exploitation of craft skills and local knowledge. By comparing their subsequent development trajectories, it was possible to understand what the triggering factors are that enable some clusters to grow, while others remain trapped in an early stage of development. Among them, as mentioned, we will focus on the role of leading firms. As described hereafter, in Montebelluna the latter are homegrown multinational firms established after the 1990s (such as Tecnica, Geox, Alpinestars, Aku, etc.) through a process of foreign firm acquisitions and greenfield investments. Few multinationals entered the cluster by acquiring Italian companies in the 1990s, such as Nike or Salomon. However, they soon exited, albeit remaining cluster clients for the subcontracting of high-quality shoes. In the Istanbul cluster, the leading role is played by large Turkish retail chains, which are also producers but which buy 40–50% of their sales from other Turkish firms mainly located in the Turkish clusters analysed in this chapter. Among the most dynamic Turkish leading firms, we must mention Zylan, which has recently entered the Montebelluna district with a greenfield investment focused on prototype design for the Turkish production. Zylan has also acquired the brand Lumberjack from Canguro (an Italian firm based in Verona), together with its distribution nets. On the other hand, the Turkish clusters in which the emergence of leading firms (or the entry of external leaders) was not observed are characterised by a low level of dynamism. Local firms are strongly focused on manufacturing activities, and their level of innovativeness is very low. They produce low- to medium-quality shoes for the large retail chains mentioned above or for buyers located in the peripheral international markets of the Middle East.

The chapter develops as follows: the second section provides an overview of the Turkish and Italian footwear industry; Sect. 3 explains the methodology and provides an overview of the firms interviewed; Sects. 4–7 are devoted to the analysis of the four clusters; Sect. 8 presents a comparative analysis of the four clusters and outlines some concluding remarks.

2 The Turkish and the Italian Footwear Industry

As stressed by the analysis of the EU Cluster Observatory, Italy and Turkey are among the main producers of footwear in Europe, and they host a relevant number of industrial clusters.[3] Moreover, the two countries are linked by relevant trade flows of specialised machineries for footwear production and footwear components and design. Italy, with its 80,000 manufacturing workers—mainly located in Marche, Veneto and Tuscany—is the largest producer of footwear in the European Union, the ninth producer of footwear (World Footwear 2011; see Table 1)[4] in the world (in terms of pairs of shoes produced) and the second largest exporter in the world in terms of value (the fourth in terms of quantity).

Italy is leader in the production of high-quality footwear, sport shoes and luxury footwear, with high fashion content. After several years of difficulties, exacerbated by the international crisis, Italian export—which is mainly directed towards the European market—began to grow again. The footwear industry in Turkey is growing fast and now employs more than 300,000 workers dispersed in the country in various clusters (Istanbul, Izmir, Konya, Ankara and Gaziantep) in more than 22,000 firms. Its growth has been driven mainly by the internal market, but in the last years

[3]http://ec.europa.eu/growth/smes/cluster/observatory_en

[4]www.worldfootwear.com/docs/2011/2011WorldFotwearYearbook.pd

Table 1 Top ten footwear producers (quantity) in 2010

Rank	Country	Pairs (millions)	World share (%)
1	China	12,597	62.4
2	India	2060	10.2
3	Brazil	894	4.4
4	Vietnam	760	3.8
5	Indonesia	658	3.3
6	Pakistan	292	1.4
7	Thailand	245	1.2
8	Mexico	244	1.2
9	Italy	203	1
10	Turkey	174	0.9

Source: World Footwear (2011)

Fig. 1 Footwear clusters in Europe. Source: European Cluster Observatory (www.clusterobservatory.eu). Note to Table: The dimension of circles corresponds to the number of employees in footwear

also, Turkish footwear exports have been growing. Figure 1 shows the localisation of footwear clusters in Europe. It is important to note that these data underestimate cluster employment, because they refer exclusively to footwear firms, stricto sensu, and do not consider the entire footwear filière, which includes producers of components, subcontractors and service firms.[5]

2.1 The Turkish Footwear Industry

According to the Turkish State Institute of Statistics (Turkey's Ministry of Economy, 2012), in 2011, the Turkish footwear industry was composed of about 4753 companies and 26,954 employees. Data from ILO (International Labour Organization) report that in 2004, the sector employed about 300,000 workers, 20,000 of whom were employed in the industry, while the rest worked in semi-mechanised and/or handmade shoe workshops.[6] The average dimension of the industrial firms was very small (5.7 employees).[7] In 2006, the footwear industry covered about 1.5% GDP and 2% of total investments (Turkish Leather Council 2012).[8] The national production consisted of leather shoes (26% of the national production of footwear in 2011), plastic shoes and slippers. In the same period, the share of the shoe component industry (e.g. soles, heels, moulds) on the total footwear industry was around 5%. There was also a small production of shoe machineries. Turkey produces women's, men's and children's shoes, sport and classic shoes, military boots and work and safety shoes. A number of famous designers are also emerging, producing luxury fashion shoes (e.g. Hussein Chalayan, who presented his collections in Paris). In 2011, Turkey's shoe production reached 212 million pairs. Currently, 70% of the demand of production inputs are met locally and 30% through imports. The main export markets are the Russian Federation, Iraq, Saudi Arabia, Germany, Bulgaria, the UK, France, Italy, the Netherlands and Romania (Table 2). In 2012, the export value was 425 Million USD. Almost 50% of the industry is located in Istanbul. The remaining 50% are in Konya, Izmir, Ankara, Gaziantep, Manisa, Denizli, Adana, Malatya and Corum.

In order to promote the upgrading of the footwear industry, in 2001 the government sponsored the creation of the Turkish Shoe Industry Research, Development

[5]In addition, as it will be further discussed in the following chapters, we have to note that the 30 firms interviewed in Istanbul declared to employ more than 12,000 workers in total; the 30 firms interviewed in Konya reported about 1521 workers, and the 24 firms in Izmir declared to have 1822 workers. In the light of this information, we can conclude that the figures presented by the EU Cluster Observatory are likely to underestimate the phenomenon.

[6]Data were collected from the report "Social Auditing in Bulgaria, Romania and Turkey," available at http://www.ilo.org/empent/Publications/WCMS_101067/lang--en/index.htm

[7]Sourced from the Turkish Government report (quoting Turkish National Institute of Statistics *www.turkstat.gov.tr/UstMenu*: http://www.tcp.gov.tr/english/sectors/sectoringpdf/footwear_2012.pdf. Following the Turkish Leather Council, in 2006, the Turkish footwear industry employed 380,000 workers in 40,000 companies (Turkish Leather Council: http://www.turkishleather.com/dtgeng/StaticPages/showpage.aspx?fname=altsektorler2.htm, accessed on December 2012).

[8]http://www.turkishleather.com/dtgeng/StaticPages/showpage.aspx?fname=altsektorler2.htm

Table 2 Interviewed firms

Cluster	No. of interviewed firms	No. of employees	Main products	Total turnover (million euros)	% of export	Avg price of product
Istanbul	30	12,290	All types of fashion shoes	1,736,638	32.4	46.0
Izmir	24	1822	Ladies and kids	48,948	24.6	35.0
Konya	30	1521	Man classic-elegant shoes	97,591	14.6	23.5
Montebelluna	30	11,612 (5589 in Montebelluna)	Sport shoes	2,378,000	74.5	70.7
Total	114	27,245		4,262,077	46.0	44.0

Source: Our interviews

and Education Foundation. "The Shoe Design Department" at Mimar Sinan University in Istanbul offers a 2-year course. Other policies have been directed to the promotion of the Turkish footwear industry. An important policy has been the establishment of a number of temporary trade barriers (as well as minimum supervision prices) on a number of products, including shoes.

2.2 *The Italian Footwear Industry*

Italy is the largest producer of footwear in the European Union. It is leader in the production of high-quality footwear and luxury footwear, with high fashion content. In 2011 the Italian footwear industry was composed of about 5606 companies and 80,925 employees. The average dimension of the firm was small (14 employees). The total production realised in 2011 amounted to 207.6 million pairs of shoes. The total value of the production realised in 2011 amounted to about 7 billion Euros (ANCI 2011). The footwear industry is a part of a larger industry that includes the production of bags and similar leather products. Moreover, the Italian machinery industry is one of the leading industries of the world in the field of shoe manufacturing. In 2011 more than 83% of the production (83% in terms of quantity; 82% in terms of value) were directed to the international market. In 2011 the average price reached 38 Euros per pair. Considering only the export of Made in Italy products (re-export excluded), in 2011 the export amounted to more than 6.2 billion Euros. The main export was towards France, Germany and the USA. During the last years, exports to Russia, China and Hong Kong have become important. The Italian footwear industry is concentrated in a number of industrial districts, mainly located in seven regions: Marche, Tuscany, Veneto, Lombardy, Campania, Apulia and

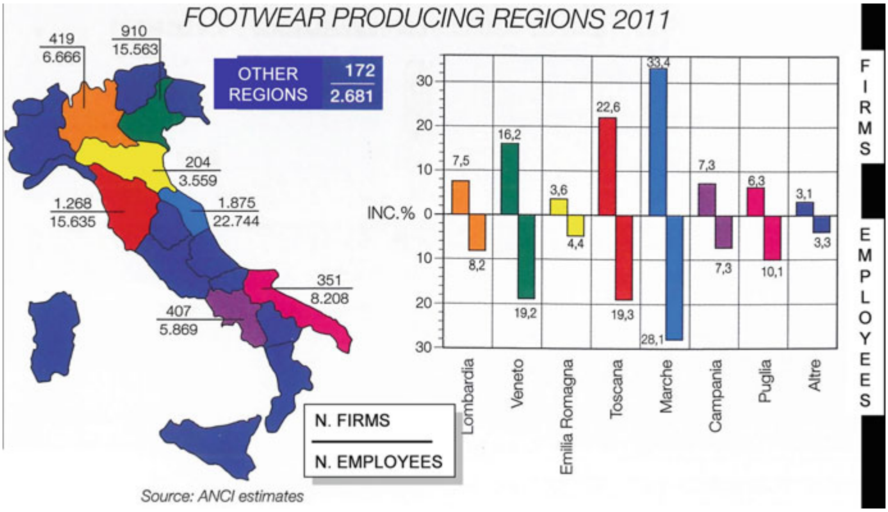

Fig. 2 The footwear industry in the Italian regions

Emilia-Romagna (see Fig. 2). A dense fabric of organisations has developed, which provides support to the development of the footwear industry: trade associations, vocational schools, specialised service and innovation centres, design institutes and others. At the same time, some of the most world famous trade fairs are organised periodically in major Italian cities for the production of specialised machinery, components and footwear fashion (e.g. MICAM, Lineapelle, etc.). Manufacturing activities—in particular the lower value-added activities—have been outsourced to other countries, while design-related activities, as well as marketing and promotion on world markets, are performed in Italy. The crisis has in many cases accelerated these trends, making a strong selection among footwear firms.

Turkey is one of the first countries of destination for Italian export of footwear machinery. Secondly, Turkey imports high-quality components from Italy, and Turkish footwear producers are also buying designs offered by various Italian fashion designers.

3 Methodology

In order to carry out this comparative analysis, a case study was performed, based on direct interviews to entrepreneurs and other local actors localised in the different clusters (Eisenhardt 1989; Yin 2011, 2013; Stake 2013). To refer to a work case study (Gerring 2004) can mean (a) that its method is qualitative, small-N (Yin 2011, 2013); (b) that the research is ethnographic, participant observation, or otherwise “in the field” (Yin 2011); (c) that the research is characterised by process tracing; and (d) that the research investigates the properties of specific phenomena. Case studies are useful for forming descriptive inferences, all other things being equal. We worked hard to build a research design that could allow high comparability. The survey planned was based on semi-structured questionnaires presented to a sample of firms randomly selected in the four clusters. The interviews were directed and performed by two Italian members of the ShoeColl EU project unit based at Padua University: Fiorenza Belussi and Annalisa Caloffi. Face-to-face interviews lasting about 1 to 2 hours were organised in Istanbul, Izmir and Konya. Researchers from the Turkish university of Konya helped the Italian team organise the work, providing assistance in identifying the footwear firms to be interviewed, in setting appointments and in the simultaneous translations of the interviews (Turkish to English). In Italy, the interviews were organised and conducted by Fiorenza Belussi and Pierpaolo Andriani. Considering that each cluster has a size of at least 300–500 firms belonging to the footwear sector, it was decided to interview about 30 firms in each cluster, in order to take into account the variety of firms and to cover the heterogeneity of the industrial structure. The interviewees were selected starting from the list prepared by the local associations of firms, which include leading firms (mostly final firms), subcontractors and producers of components. Interviews were performed in Istanbul in April 2012, in Izmir in September 2011, and in Konya in November 2012.[9]

Table 2 provides an overview of the basic features of the firms interviewed. The Turkish clusters produce a medium-quality product, mostly ladies' leather shoes, but also other types of shoes, such as men and kid shoes, whereas the Italian cluster produces ski boots and other types of sport shoes. The average price for the shoes (charged by firms to customers) is higher for the technical shoes of the Montebelluna cluster and lower for the more traditional products made in Konya. In the Turkish clusters, the production is primarily for the domestic market, while in Montebelluna the target market is (mainly) international.

In what follows we provide some additional information on the firms interviewed in the four clusters.

Konya The firms interviewed were generally final footwear producers (26 firms). The sample included producers of components and parts (two producers of soles, one producer of moulds and one producer of carton boxes) (four firms). The 26 final firms produce women shoes (4 firms), men and women shoes (3 firms) and men shoes (19 firms). Most of them are small-sized, but the three largest firms in the cluster were interviewed as well (in the category 101–500 employees) (Table 3). The year of foundation of the majority of firms interviewed dates back to the 1960s, 1970s and 1980s, while only a few firms were founded in the 2000s. Firms are mainly low-tech, and they employ mostly unskilled labour (Table 4).

[9]We would like to thank the following persons who helped us organise the interviews and provide a simultaneous translation from Turkish to English: Zeliha Celik from Istanbul, Ersen Vural from Izmir and Zarif Songül Göksel from Konya. We also thank Sedef Akgungor from the Dokuz Eylul University (Izmir) for sharing her ideas with us about Izmir and its footwear cluster. Adem Ogut and Selcuk Karayel from the University of Konya helped us organise the empirical research in Turkey.

Table 3 Firms by size

	1–49 employees	50–100 employees	101–499 employees	500 and more	Total
Konya					
Footwear firms	19 firms (526 employees)	4 (320)	3 (580)	0	26 (1426)
Producers of components	4 (100)	0	0	0	4 (100)
Izmir					
Footwear firms	9 (202)	9 (828)	3 (722)	0	21 (1752)
Producers of components	3 (70)	0	0	0	3 (70)
Istanbul					
Footwear firms	9 (210)	7 (555)	11 (11,450)	0	27 (12,215)
Producers of components	3 (75)	0	0	0	3 (75)
Montebelluna					
Footwear firms	9 (270)	8 (531)	5 (921)	3 (9500)	25 (11,222)
Producers of components	2 (65)	2 (130)	1 (195)	0	5 (390)

Source: Our interviews

Table 4 Employees by type

	Konya	Izmir	Istanbul	Montebelluna (considering only workers in Montebelluna)
Managers	78 (5.1%)	165 (9.1%)	307 (2.5%)	346 (6.2%)
Technicians	18 (1.2%)	56 (3.1%)	191 (1.6%)	576 (10.3%)
Designers/pattern makers	47 (3.1%)	35 (1.9%)	131 (1.1%)	186 (3.4)
Skilled workers	311 (20.4%)	1022 (56.1%)	6427 (52.3%)	3705 (66.3%)
Unskilled workers	1072 (70.2%)	544 (29.9%)	5234 (42.5%)	776 (13.8%)
Total	1526 (100%)	1822 (100%)	12,290 (100%)	5589 (100%)

Source: Our interviews

Izmir The firms interviewed are mostly SMEs (almost 90% of the firms interviewed have less than 100 employees). Most of them are family firms, and their origin dates back to the 1970s and 1980s. Many local firms are run by second-generation entrepreneurs: some of them are young English-speaking entrepreneurs who returned to their family business after studying abroad. Most of the firms produce ladies' shoes. Some of the firms produce fashion shoes, while other casual sport shoes, with technical soles and materials. Products are of medium quality, and in order to manufacture them, firms employ a quite non-negligible share of skilled workers (more than 50%). Traditional products, such as leather male shoes, are facing a decline in demand because of the changing tastes of the young generations.

Istanbul The 30 firms interviewed employed 12,290 workers. The majority of the firms (27 firms) produce finished goods (including 2 firms mainly involved in the trading of finished shoes), but we also interviewed 3 producers of components (soles and uppers). Among the final producers interviewed, there are the very large companies Ziylan, Gezer, Hotic and Metropolis, which are described in Sect. 6. They are the most innovative and dynamic organisations inserted in our sample. They are family business firms, although large organisations, and often their founders are still working in the company. In the other cases, local entrepreneurs are mainly second- or third-generation entrepreneurs. Firms in the Istanbul cluster are mainly low-tech, and they employ a large number of unskilled employees (40% of the total workforce). Most of the firms perform the entire production cycle internally.

Montebelluna The firms interviewed are generally final footwear producers, but we included in our sample also five producers of components and machinery (one producer of soles, one producer of moulds, one producer of high-tech components, one producer of machinery and one of injection parts). In total, the firms interviewed employ 11,612 workers (both in Italy and abroad) of whom 5589 localised in the Montebelluna cluster, and the average size in Montebelluna is about 200 employees (about 400 employees if we consider all workers linked to the Montebelluna firms). In our sample, unskilled workers represent only 13.8% of the total workers, while managers and technicians cover about 16% of the total workforce and while designers and pattern makers 3.40%. The presence of designers within the firms is quite common. Moreover, firms also use external (local) designers.

4 The Konya Cluster

Konya is one of Turkey's six largest cities in terms of populations. The city has experienced growth also owing to local policies promoting the creation of industrial areas (Organised Industry Zones and industrialised sites), which have attracted a lot of small- and medium-sized enterprises (SMEs). The city hosts a footwear cluster, located in the Aykent district, where there are about 100 firms and around 5000 employees. On the basis of the data provided by the local chamber of commerce, the production capacity of the local firms is about 15–20 million pairs of shoes per year. The Aykent district was created during the 1960s thanks to an agreement among the local footwear firms, the footwear firm association (Komek) and the Municipality of Konya. Firms located in Aykent have their production facilities near the commercial facilities and the warehousing; sometimes all activities are located on different floors in the same building. The industrial area also hosts a school for designers and pattern making, founded in 2013, as well as a number of logistic platforms. Currently the area does not host any facility for waste disposal. Thus, casual burning of leather and other materials is carried out during the day around the empty grass areas. This obviously makes the district a polluted area.

4.1 Economic Characteristics of the Firms Interviewed

The cluster is still in a development phase. Despite the global crisis of 2008, in the last 5 years, 80% of the final producers have increased their sales, and all producers of components have declared to be in a phase of growth. In 2011, the firms interviewed produced about four million pairs, corresponding to an aggregate value of sales of about 90 million Euros (Table 5). The average price (in factory) of shoes is in the range of 15–35 Euros. The average price for the producers of components (mainly soles) is 2.0 Euros. These prices suggest that, on average, the product manufactured in Konya is of medium-low quality. However, the reason for such relatively low prices (if compared to Europe) is also the low cost of labour. In Konya (and in Turkey), monthly wages are about 400–550 Euros for low-skilled workers and about 800–1000 Euros for high-skilled workers. Salaries are generally higher in Istanbul than in the other clusters. Whereas, in Montebelluna (and in Italy), monthly wages are, respectively, 1000–1200 Euros and 2000–2200 Euros. In addition, the weight of indirect costs (pensions, welfare, unemployment subsidies and health system) is about 30% of the salaries in the Turkish footwear firms, while in Italy, they outweigh 100% of the salaries.

On average, footwear firms in Konya export 7.5% of their sales, while producers of components export 13.8% of their sales. Only six firms export to the rich countries of Europe (the UK, Germany, Austria, Norway, Switzerland and Belgium). No one is exporting to the USA. The majority of firms combine the production with their own brand with the subcontracting activity, while five firms are only subcontractors working for other Turkish firms (mostly for large retail chains owners), and only two firms produce with their own brand (Table 6). The production cycle of the firms is not automated, and the productive cycle is often organised with old, stand-alone machines. Only in four firms the stand-alone machines are placed very near each other to simulate a moving assembly line. In addition, the labour force payment system used by firms (payment "by piece") does not stimulate the adoption of advanced technologies. In only one (the largest and more technologically advanced firm of the cluster), some research and development (R&D) activities were found (Table 7).

4.2 Relationships with Subcontractors and Main Competitors

About 60% of the firms interviewed rely on the activity of subcontractors, which are mainly local (Table 8). Therefore, the Konya model could be similar to a "pure" self-contained Marshallian district, while the Italian clusters are more and more open

Table 5 Firms' performance on national and international markets

	Sales 2011 (thousand euro)	Annual output (quantity)	Avg price (Euros)	Avg value of export (% on the total prod)	Changes in sales in comparison with December 2007			Total firms
					Growth	Stability	Decline	
Konya								
Footwear firms	89,166	3,897,000	23.5	7.5	21	5	0	26
Producers of components	8425	7,350,000	2	13.8	4	0	0	4
Total	97,591	11,247,000	20.6	8.34	25	5	0	30
Izmir								
Footwear firms	42,358	1,361,450	35	20	17	0	4	21
Producers of components	6590	2,650,000	2	15	3	0	0	3
Total	48,948	4,011,450	30.9	19.3	20	0	4	24
Istanbul								
Footwear firms	1,736,638	107,929,000	43.2	35.7	26	0	1	27
Producers of components	900	90,000	nd	1.75	2	1	0	3
Total	1737,538	108,019,000	nd	32.3	28	1	1	30
Montebelluna								
Footwear firms	2,628,000	70,130,000	72.2	63.0	11	6	8	25
Producers of components	35,000	nd	nd	0	0	3	2	5
Total	2,663,000	nd	nd	52.5	11	9	10	30

Source: Our interviews

Table 6 Firms with own brand

Number of firms producing:	Konya	Izmir	Istanbul	Montebelluna
With own brand	2 (6.6%)	6 (25%)	6 (20%)	21 (70%)
With own brand and for subcontracting	23 (76.6%)	14 (58.3%)	21 (70%)	5 (16.6%)
Only for subcontracting	5 (16.8%)	4 (16.7%)	3 (10%)	4 (13.4%)
Total	30 (100%)	24 (100%)	30 (100%)	30 (100%)

Source: Our interviews

Table 7 Firms that perform internal activities

Number of firms that perform:	Konya	Izmir	Istanbul	Montebelluna
Assembling	30 (100%)	23 (95.8)	29 (96.7%)	11 (36.7%)
R&D	2 (6.6%)	21 (87.5)	2 (6.6%)	28 (93.3%)
Design	2 (6.6%)	21 (87.5)	29 (96.7%)	28 (93.3%)
Logistics	6 (20%)	24 (100%)	27 (90%)	24 (80%)
Marketing	3 (10%)	23 (95.8%)	22 (73.3%)	25 (83.3%)
Sales	29 (96.7%)	24 (100%)	28 (93.3%)	24 (80%)
Only prototypes	0	0	1 (3.3%)	12 (40%)
All manufacturing phases are outsourced	0	0	0	3 (10%)

Source: Our interviews

Table 8 Location of subcontractors (multiple options allowed)

Number of subcontractors located:	Konya	Izmir	Istanbul	Montebelluna
In the cluster	192	57	951	146
In the region	0	0	50	0
In the country	5	0	265	0
Abroad	0	17	95	87
Number of firms without subcontractors	12	10	14	5

Source: Our interviews

systems connected with global supply chains, as illustrated, for instance, in the case of Montebelluna. Also the indicator of the subcontractors' stability shows the existence of characteristics typical of the "Marshallian" model. In fact, 15 firms out of 18 have declared in the last 3 years to have maintained stable relationships with about 70% of their subcontractors. Such relationships are closed to a partnership model (55.6%), instead of a pure market model, in which relationships are based on prices (44.4%) (Table 9).

The competitive arena of the cluster firms interviewed is national (93.3% of cases). On the other hand, Middle East producers or Taiwan-Chinese firms are not perceived as potentially threatening rivals. The measures adopted in Turkey were successful, while the European import barriers fixed at 10% of the value of the product failed to protect the national shoe industry in all European countries and

Table 9 Type of relationships with subcontractors

Number of firms having relationships with:	Konya	Izmir	Istanbul	Montebelluna
Local subcontractors				
Leadership	0	0	4 (23.5%)	13 (62%)
Partnership	10 (55.6%)	6 (42.9%)	8 (47.1%)	1 (4.8%)
Market relations	8 (44.4%)	8 (57.1%)	5 (29.4%)	7 (33.3%)
Total	18 (100%)	14 (100%)	17 (100%)	21 (100%)
Extra-local subcontractors				
Market relations	0	0	2 (22.2%)	8 (36.4%)
Partnership	1 (100%)	0	3 (33.3%)	1 (4.5%)
Market relations	0	3 (100%)	4 (44.5%)	13 (59.1%)
Total	0	3 (100%)	9 (100%)	22 (100%)

Source: Our interviews

Table 10 Localisation of main competitors (multiple options allowed)

Number of firms whose competitors are located:	Konya	Izmir	Istanbul	Montebelluna
In the cluster	1 (3.3%)	22 (91.7%)	24 (80%)	29 (96.7%)
In the same region	0	2 (8.3%)	19 (63.3%)	0
In the same nation	28 (93.3%)	7 (29.2%)	19 (63.3%)	5 (16.7%)
In another nation of Middle East	0	1 (4.2%)	4 (13.3%)	16 (63.3%)
In China	2 (6.6%)	10 (41.7%)	9 (30%)	12 (40%)

Source: Our interviews

Italy in particular. Although many in the EU protested against this violation of the international GATT agreements, the temporary protectionist strategies were reconfirmed by the government (Table 10).

4.3 *Levels of Innovativeness of the Cluster Firms in Konya*

The firms interviewed do not develop original products and new technologies but adapt existing designs of other firms (mainly Italian designs, but also those of some emerging firms that belong to the Istanbul cluster). Only in two cases the firms were clearly developing an original design (Table 11). The firms interviewed declared that they change about half of their models each year. The technologies in product (CAD) and processes (machinery) used by the Konya cluster firms mainly come from abroad (Italy, Germany, Taiwan) (in 93.3% of firms) (Table 12). The adoption of ICT for general management, e-commerce and networking purposes is low (Table 13). One important topic discussed in our interview was how firms develop

Table 11 Level of innovativeness of cluster firms (multiple options allowed)

Number of firms developing:	Konya	Izmir	Istanbul	Montebelluna
Original products	0	0	0	23 (76.7%)
Original technologies	0	0	2 (6.6%)	23 (76.7%)
Original design	2 (6.6%)	2 (8.3%)	6 (20%)	23 (76.7%)
Adapts the design/products/ technologies of other firms	29 (96.7%)	24 (100%)	29 (96.7%)	7 (23.3%)
Not applicable	1 (3.3%)	0	1 (3.3%)	1 (3.3%)
% of new models introduced in the market every year[a]	51.8	52	55.5	59.6

Source: Our interviews
[a]Producers of components and machinery and firms working 100% for subcontractors are not included

Table 12 Technology sourcing (multiple options allowed)

Number of firms that use technologies coming from:	Konya	Izmir	Istanbul	Montebelluna
Local market	1 (3.3%)	6 (25%)	1 (3.3%)	29 (96.6%)
Regional market	0	0	0	0
National market	2 (6.6%)	14 (58.3%)	6 (20%)	1 (3.3%)
Foreign countries	28 (93.3%)	14 (58.3%)	26 (86.7%)	14 (46.7%)
Technologies are provided by the client	0	0	0	3 (10%)

Source: Our interviews

Table 13 Use and investments in ICT in the interviewed firms based on the business strategy adopted (ranking from 0 to 5) (multiple options allowed)

The firm invest in ICT in order to:	Konya		Izmir		Istanbul		Montebelluna	
	Number of firms	Avg ranking	Number of firms	Avg ranking	Number of firms	Avg ranking	Number of firms	Avg ranking
Connecting with clients and suppliers	30	2.5	24	1.79	30	3.9	30	3.7
Management purposes	30	0.1	10	0.58	30	2.1	30	3.77
Developing e-commerce strategy	0	0	0	0	18	0.7	30	3.47
Improve network efficiency	0	0	3	0.21	16	0.5	30	3.17

Source: Our interviews

and improve their technological capabilities. On-the-job training is very common among the firms of our sample, while more complex forms of learning (use of consultants and supervisors) are absent (Table 14).

Table 14 Presence of spontaneous and formal learning activities (multiple options allowed)

Number of firms implementing the following activities	Konya	Izmir	Istanbul	Montebelluna
Spontaneous learning				
On-the-job training	30 (100%)	24 (100%)	28 (93.3%)	28 (93.3%)
On-the-job training with the supervision of experts	0	11 (45.8)	4 (13.3%)	21 (70%)
Clients/supplier interaction	0	8 (33.3%)	5 (16.7%)	20 (66.7%)
Use of consultants	0	5 (20.8%)	6 (20%)	18 (60%)
Imitation of strategies and product of competitors	3 (10%)	14 (58.3%)	5 (16.7%)	5 (16.7%)
Formal learning				
Internal training	29 (96.7%)	18 (75%)	28 (93.3%)	28 (93.3%)
External training	0	4 (16.7%)	5 (16.7%)	25 (83.3%)
Benchmarking activities	0	6 (25%)	3 (10%)	18 (60%)
Participation to institutional project and initiatives promoted by local and/or industry association	2 (6.6%)	1 (4.2%)	0	1 (3.3%)
Visit to "best-practice" companies	2 (6.6%)	0	0	5 (16.7%)

Source: Our interviews

The two most important external sources of knowledge mentioned (on a 1–5 Likert scale) were (a) national private service providers (3.47) and (b) national exhibitions or conferences (3.47), international private service providers (2.17) and international exhibitions or conferences (2.17) (Table 15). Drawing on these data, local sources seem to play a marginal role, and this is in contrast with all the literature on industrial districts and clusters that magnifies the importance of local spillovers. Contrary to what happens in the majority of developed clusters, competitors, subcontractors, partner firms, clients and local associations appear ineffective in sustaining innovation. Also universities and research centres are not mentioned by the firms interviewed as sources for information on new technologies.

To conclude, important linkages are external-to-the-cluster. Entrepreneurs mention the case of PDG, a firm from Verona, well known in the sector for its innovative skills owing to the fact that its technicians regularly visit the USA, discovering new high-tech materials produced by NASA and other innovative firms, which they then transfer and adopt in their shoes components. Firms often buy Italian design from Italian designers based in the Marche district. Special steels for moulds also come from Spain, Austria and Sweden. The Internet seems to be the most important source of information about fashion trends (2.43). Another low-cost source frequently used by the firms interviewed is the access to journal and specialist magazines (0.37), as well as local shops (0.37), national clients (0.30) and international travels (0.27) (Table 16).

Table 15 Sources of information about new technologies (relevance from 0 to 5) (multiple options allowed

Number of firms using the following sources:	Konya		Izmir		Istanbul		Montebelluna	
	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank
Competitors								
Local	0	0	2	2	0	0	73	2.43
National	6	0.2	3	3	0	0	59	1.97
International	0	0	3	3	4	4	81	2.7
Clients								
Local	0	0	8	4	0	0	4	0.13
National	12	0.4	13	3.3	47	4	0	0
International	0	0	6	3	13	3.2	89	2.97
Subcontractors and specialised suppliers								
Local	0	0	7	3.5	0	0	96	3.2
National	0	0	4	4	0	0	0	0
International	0	0	17	4.3	78	4.3	83	2.77
Marketing research								
Local	11	0.37	0	0	7	3.5	2	0.07
National	0	0	0	0	11	3.7	0	0
International	0	0	0	0	26	4.3	7	0.23
Other partner firms								
Local	0	0	13	4.3	0	0	3	0.1
National	0	0	4	4	8	4	0	0
International	0	0	0	0	9	4.5	78	2.6
Business associations								
Local	2	0.07	0	0	8	4	2	0.07
National	0	0	0	0	0	0	0	0
International	0	0	0	0	0	0	0	0
Service centres								
Local	0	0	0	0	0	0	6	0.2
National	0	0	0	0	0	0	0	0
International	0	0	0	0	0	0	6	0.29
Private service providers								
Local	0	0	14	4.7	0	0	3	0.1
National	20	3.47	0	0	3	3	4	0.13
International	20	2.17	4	4	4	4	8	0.27
Universities and research centres								
Local	0	0	3	3	14	3.5	10	0.33
National	0	0	0	0	11	3.7	12	0.4
International	0	0	0	0	2	2	17	0.57
Exhibitions or conferences								
Local	0	0	0	0	81	4.8	0	0
National	104	3.47	45	4.1	106	4.4	25	0.83
International	65	2.17	65	4.6	134	5.0	107	3.57

Source: Our interviews

Table 16 Sources of information about fashion trends (importance from 0 to 5) (multiple options allowed)

Number of firms using the following sources:	Konya		Izmir		Istanbul		Montebelluna	
	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank
Clients								
Local	0	0	23	3.8	5	5	9	1.8
National	9	0.3	22	3.7	60	3.7	8	1.77
International	4	0.13	23	3.8	35	3.9	8	1.77
Subcontractors and specialised suppliers								
Local	0	0	3	3	0	0	13	1.93
National	0	0	3	3	2	2	0	0
International	0	0	13	4.3	7	3.5	4	0.30
Other partner firms								
Local	0	0	8	4	0	0	1	0.03
National	4	0.13	0	0	0	0	0	0
International	0	0	0	0	0	0	0	0
Own marketing research or own agents								
Local	0	0	0	0	8	4	0	0.17
National	0	0	0	0	13	4.3	0	0.1
International	0	0	0	0	13	4.3	4	0.3
Designers and fashion studios								
Local	3	0.1	24	4	8	4	16	1.57
National	10	0.3	0	0	19	3.8	6	0.33
International	13	0.37	12	4	49	4.5	12	1.5
Shops or retailing nets								
Local	11	0.37	3	3	5	5	0	0
National	4	0.13	0	0	37	4.6	4	0.23
International	0	0	4	4	13	4.3	12	1.5
Business associations								
Local	0	0	0	0	4	4	3	0.2
National	0	0	0	0	0	0	0	0.1
International	0	0	0	0	0	0	0	0.1
Service centres								
Local	0	0	0	0	0	0	0	0.07
National	0	0	0	0	0	0	0	0.1
International	0	0	0	0	0		3	0.2
Universities and research centres								
Local	0	0	4	4	7	3.5	0	0.07
National	0	0	0	0	11	3.7	0	0.07
International	3	0.1	0	0	0	0	2	0.17
Sector exhibitions								
National	3	0.1	28	4.7	88	3.5	21	1.47
International	10	0.33	53	4.8	140	5	36	4.4

(continued)

Table 16 (continued)

Number of firms using the following sources:	Konya		Izmir		Istanbul		Montebelluna	
	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank	Total rank	Average rank
Travels								
National	5	0.17	0	0	48	3.4	34	3.57
International	8	0.27	33	4.7	112	4.7	34	3.57
Competitors								
Local	0	0	0	0	8	4	20	2.17
National	16	0.53	8	4	3	3	9	1.8
International	0	0	14	4.7	49	4.5	15	2.5
Others								
Journals and specialist magazines	13	0.37	78	4.6	103	4.7	38	4.93
Internet	73	2.43	70	4.7	120	4.6	36	4.87

Source: Our interviews

5 The Izmir Cluster

Izmir is the centre of the Aegean Region. The Region, and Izmir in particular, has developed rapidly over the last 20 years thanks to a number of advantages such as the presence of important manufacturing traditions in many fields and the presence of clusters of SMEs specialised in sectors such as food processing, textiles and clothing, footwear and automotive. In recent years, the city has attracted a non-negligible number of foreign investors. Public policies have tried to promote the growth of industrial clusters (Kumral and Akgüngör 2006).The origins of the footwear cluster are quite old, dating back to about 100 years ago. The first firms were founded by Jewish and Armenian traders, who used to import and export shoes in Europe and in the nearby Mediterranean countries. In the 1920s, a large public-owned company was founded, Sumeri Bank, which produced also leather shoes. The company closed down during the 1980s, and from that moment on, the ex-workers founded many footwear firms in the area thanks to the knowledge acquired previously. Currently, the cluster hosts more than 3500 footwear firms and 45,000 employees (data provided by The Local Footwear Association 2011). The cluster is organised around several industrial areas such as Issikent. The industrial areas are composed of various plants where firms can locate their production (or part of it) and showrooms. Small firms can also buy or rent small showrooms in large buildings where they can show their products to potential clients. The footwear association has also promoted the creation of a vocational school and a footwear museum. In total, Izmir hosts four vocational schools for footwear workers. In addition to vocational schools, there are two local university departments that offer special courses in fashion and industrial design.

5.1 Economic Characteristics of the Firms Interviewed

Considering exports and sales, the cluster seems to be in a phase of development. Comparing the turnover of 2011 with that of 2007, most of the firms interviewed claimed to be in a situation of growth (both final producers and producers of components) (Table 5). In 2011, the firms interviewed generated a total turnover of almost 50 million Euros and sold about 1.4 million pairs of shoes. The average factory price amounts to 35 Euros for shoes and 2 Euros for soles. Local firms are mainly working for the domestic market. They sell their products to large Turkish retail chains or large firms such as Kemal Tanca, Hotic (a high fashion content company based in Istanbul, selling also online), Zippers and Zealand, as well as to global retailers such as Tesco, Polaris and the German low-cost large retailer Deichmann, which currently counts more than 1000 shops in Germany and opened its first shops in Turkey in 2006. Only few local firms are high exporters (70–80% of sales). Others export 20–30% of their sales. Their foreign clients are mainly located in Russia, Iran, Uzbekistan, Turkmenistan, Egypt and Iraq but also in Canada, Holland, Germany and Finland. Most of the local firms produce with their own brand. However, about 60% of the local firms combine autonomous production with subcontracting activity (Table 6). As for the interviewed firms' internal organisation, crucial activities are organised inside the firms, and only about 50% use external subcontracting for manufacturing the upper part of the shoe (Table 7). This is in strong contrast with the typical Italian district where the majority of firms rely on a large number of subcontractors for performing shoe manufacture and assembly. Izmir's firms also produce their prototype seasonal collection in-house.

5.2 Relationships with Subcontractors and Main Competitors

Most of the local firms use raw materials such as leather sourced locally. Only few special components—such as special soles, thread for shoes and fashion accessories—are imported from Italy (Table 8).

Relationships with local subcontractors are often long-term, sometimes characterised by trust-based relations. Subcontracting firms often collaborate with the final firms for the design of the shoe or part of it. The relationship with foreign partners takes the form of a "market" relation, in which the most important element for the final firm is to reduce the cost of the order to the minimum level (Table 9). In Izmir there are no local trade unions contracting salaries and benefits for workers. This is in line with the existence of low salaries (400–600 Euros per month), exploitative working conditions and long working hours (about 10–12 hours per day for 6 days a week in the peak of the season). Thus, in this cluster, the existence of frequent trust-based relationships is far from an idyllic Italianate model of an industrial district characterised by high-wages and high-satisfactory working conditions.

Most of the competitors of the firms interviewed come from the same cluster, but about 30% of the firms interviewed also declared to struggle against competitors coming from other areas in Turkey, and 42% are aware of the possible threat of Chinese firms (which has been blocked by the government with the introduction of trade barriers) (Table 10).

5.3 Levels of Innovativeness of the Cluster Firms

The firms interviewed in Izmir do not develop original technologies but buy them on the international market (in Italy in particular) or on the national market (Table 11). The firms buy the most sophisticated machines from Italy or, to better phrase it, from Italian distributors of Italian machineries that often visit the shoe firms in Izmir and participate in footwear exhibitions that take place in Izmir, as well as in other Turkish cities (Table 12). The technological level of the companies surveyed is not particularly high: in most cases, shoes are 100% handmade. Also the use of ICT is not very much widespread, as only one firm uses CAD-CAM (Table 13). Generally speaking, information on new technologies comes from international and national exhibitions. Izmir's firms declared to participate in the SMAC exhibition in Bologna and the SIMA exhibition in Ancona, that is, fairs specialised in footwear machineries (Table 15).

The firms interviewed in Izmir do not develop original designs. Instead, all of them adapt the products and the design of Italian and international competitors. Going to exhibitions in Istanbul and Italy is one of the most important channels used by the local firms in order to update their knowledge on market fashion trends. Moreover, most of the local firms use journals and specialist magazines and travel to international destinations. The contact with clients is another relevant channel which allows Izmir firms to absorb new knowledge on fashion trends. Also contacts with professional designers and fashion studios are important. Designers are often local, but in three cases, Izmir firms contacted Italian designers from the region of Marche to embellish their models (Table 16).

The infra-district model for spreading information on technology and fashion resembles a "direct peer" mechanism (Belussi et al. 2011). In the district no gatekeeper firm was found absorbing new information (on technologies or markets) from abroad. Cooperation among firms is limited to the vertical dimension of subcontracting relations. Training is realised only using on-the-job mechanisms or combined with the supervision of experts (46% of firms). Entrepreneurs declared that they improved their capabilities in design attending design courses in Italy (Table 14).

Manufacturers in Izmir are very much in line with the fashion production made in Istanbul and in other European cities. Firms have developed design functions internally. Models seen in fashion magazines, or on the Internet, are copied and adapted. In order to enrich the fashion content of the products, some companies have also started to collaborate with Italian designers. Shoes produced by Izmir factories are sold at a very low price: 20–25 Euros. This is the strategic element that justifies their high competitiveness. The factories visited were technologically backwards and highly verticalised. In Izmir there is no inter-firm division of labour, and this is in strong contrast with the ideal typical model of the Marshallian district, at least in its Italianate version. Only in 1 factory out of 25 a high level of mechanisation was found with the presence of a moving chain. The fear of being copied was adduced by entrepreneurs for the absence of the inter-firm division of labour.

6 The Istanbul Cluster

Istanbul is Turkey's largest city (about 13 millions of inhabitants) and the third metropolitan area in Europe, after Moscow and London. In 2010, the GDP per capita was nearly half of that of the main European countries: 10,339 USD. The Turkish leather industry, which has a 500-year-long history, is at the core of the development of the footwear sector. The shoe industry, which emerged as a small-sized industry in the 1950s, is nowadays one of the most important industries in the country and an important industry in the city. The area of Aymod in Istanbul hosts the most important footwear international trading offices, the main design studios and the headquarters of the most important Turkish footwear firms. Larger firms are localised in the metropolitan area, but there is also a specialised industrial area, Aymakoop, which is located near the international airport. The area, which is similar to those existing in Izmir and Konya, has developed a cluster brand (Aymakoop cluster; www.aymakoop.com.tr). In this cluster, the entire footwear filière can be found: final firms, suppliers, sellers of components and raw material (leather), offices for the repairs of machinery and service firms. The offices of the footwear association (TASD) are also located close to Aymakoop, as well as the specialised school TASEV, which is endowed with very modern testing machinery and control instruments, which, however, are not very much used by the Istanbul firms. Firms localised in this area seem to be better organised than those in the other Turkish clusters. The working environments of small firms appear to be cleaner, safer and more modern. Over time, firms have made some investments in machineries, but only few firms have completed the whole industrialisation process. In the last years, Turkey has substantially increased its exports to neighbouring Russia and Iraq, which have become its main clients.

6.1 Economic Characteristics of the Firms Interviewed

The Istanbul cluster is in a development phase. Despite the global crisis of 2008, in recent years 93.3% of final producers have increased their sales, and all producers of components have declared to be in an expansion phase. In 2011, the firms interviewed produced about 108 million pairs, corresponding to an aggregate value of sales around 1737 million Euros (Table 5). The average price (in factory) of shoes produced is quite high for Turkey: 43 Euros. Prices range from 5 Euros for plastic sandals to 250 Euros for luxury shoes. On average, footwear firms export 36% of their sales abroad, while producers of components export very little (1.8 of their sales). Export flows are mainly directed towards the Middle East, such as Iran, Iraq, Uzbekistan and Russia.

Most of the firms interviewed produce with their own brand, as well as with their clients' brand (Table 6). Nearly all firms perform manufacturing, design, logistics, sales and marketing internally (Table 7). Owing to our factory visits, we can assert that, in general, the production cycle of the firms in Istanbul is more automated than in Izmir or Konya and that many entrepreneurs are proud to have inserted in the factory some automated machinery in CAD-CAM or in laser technologies. This element is also correlated to the large size of the firms, which allows to benefit from automation and scale economies. Indeed, in six firms we found the moving assembly line.

The cluster is home to a number of leading firms, which we interviewed. The largest firm of our sample, Ziylan, has more than 3000 employees (about 6000 if we consider the whole Ziylan group, which includes 12 companies). Founded in 1972 in Gaziantep and initially specialised in the production of soles, the company currently performs manufacturing and sales activities. It owns 120 shops in Turkey, and 9 in foreign countries; the first foreign shop opened in 2001. Ziylan has several registered brands: Polaris, Kinetix, Flo, Flogart, Torex, Halley, Dockers, and Carmens. Considering the aggregate output, Ziylan Group is as large as Geox, a well-known international brand of the Montebelluna cluster. However, the Ziylan brand is recognised only in Turkey, and its production is focused on less costly products. Recently it opened a subsidiary in the Montebelluna district in Italy (Brand Park).

The second large firm is Gezer, which is a large producer (about 76 million pairs per year) of low-quality-low-price rubber and plastic shoes. The company has two offices in China which manage the relationships with local subcontractors and five plants in Turkey. Gezer sells its products to about 600 autonomous shops and 45 wholesalers.

Another large producer is Hotic, founded in 1938. In terms of sales, Hotic is nearly half the size of Ziylan (one third, if we consider the pairs produced). Hotic is inserted in the high-quality segment, more similar to the "Made in Italy", and employs designers living in Milan. Similar to Ziylan, Hotic's business model combines production and commercialisation. Hotic controls a net of 85 shops in Turkey, few of which in franchising, and 5 shops abroad (the most recent opened in Dubai).

The cluster also includes a large number of dynamic companies, many of which have their own internal designers. The presence of designers employed by the firms suggests that the latter have a certain degree of autonomy on the market and the ability to create (or imitate) new models. Moreover, a large number of firms in Istanbul use creative designers coming from the city or even from Italy for the design of new models such as Hotic and Kemal Tanca. Cabani works with Italian firms such as Paciotti; Molyer has opened a showroom in Italy, and King Paolo is now a distributor of the American brand "Hush Puppies."

6.2 Relationships with Subcontractors and Main Competitors

The firms interviewed work with 951 subcontractors mostly localised in the cluster and with 265 subcontractors localised in the country. More than half of the firms interviewed rely heavily on subcontractors' activity. On average, every firm deals with 73.2 subcontractors located nearby and with 53 subcontractors located in the country. Moreover, 5 interviewees operate with 95 subcontractors located abroad (Table 8). This represents a strong evidence of the initial internationalisation of the Istanbul cluster. Larger firms produce the most labour-intensive low-value phases in China, Taiwan, Vietnam and India. Some professional traders based in Istanbul supply the largest Turkish chains (Kemal Tanca, Hotic) with low-cost items manufactured in China. A trader we interviewed estimated that the Chinese import of semi-finished or finished goods covers half of the internal shoe market.

The relationship with subcontractors here is less stable than in other clusters. Only about 51% of the firms interviewed have maintained stable relationships with their subcontractors. However, most of the firms have a partnership-type relation with their subcontractors (Table 9).

All main competitors are located here. For only 33.3% of the interviewed entrepreneurs, China appears to be a threat (Table 10).

6.3 Levels of Innovativeness of the Cluster Firms in Istanbul

In the footwear industry, the activity of copying the models of international rivals is very diffused. However, every firm reaches large success only if it is able to differentiate its style from that of the other competitors. Among the Istanbul firms, even if the design is not always truly original, the activity of adaptation and redesign requires much effort (Table 11). This is confirmed by the indicator referred to the presence of designers and pattern makers in firms, as well as by the number of new products introduced in production every year (measured as weight on sales), which, on average, is about 55%. Among the firms interviewed in the footwear cluster, six had the capability of developing in-house "original and innovative" new products, consisting in a radical new design. Only two firms (Ziylan and Gezer) had developed new technologies protected by international patents (EPO patent). Innovations internationally patented regarded waterproof soles and injected soles. For the majority of the sample (86.7%), new technologies come from abroad (Italy, Germany, Taiwan). Local firms buy foreign technologies from the international producers of footwear machinery (through their Istanbul dealers) (Table 12). The use and investments in ICT declared by the Istanbul firms was significantly in contrast with the results obtained in the other two clusters of Izmir and Konya (Table 13). On-the-job training was very common, while more complex forms of learning were not commonly applied (Table 14).

The three most important sources for knowledge acquisition indicated by our interviewers are (a) international exhibitions or conferences, (b) national exhibitions or conferences and (c) international subcontractors and specialised suppliers. Drawing on these data, local sources seem to play a marginal role. In fact, Istanbul firms appear to benefit more from external and international linkages. The participation in international fairs is the most important source of information on fashion. Also the Internet seems to be a crucial source. Fashion is also absorbed through international travels and the reading of journals and specialist magazines (Tables 15 and 16).

7 The Montebelluna Cluster

The Montebelluna cluster, in the province of Treviso, includes about 400 companies and 6000 employees located in Montebelluna, while about 11,200 workers are employed globally by the Montebelluna firms (AIDA source). Montebelluna is the world leader in technical sport shoes, ski and trekking boots, motorcycle boots and bicycle shoes. Open to the international business, the district is also characterised by the presence of several international companies and by homegrown multinationals (Sedita et al. 2013) developed in the 1990s. However, nowadays the district is still characterised by a non-negligible number of midsize family firms and by some important large Italian-owned companies. The latter originate from the initiative of the first founders of the district, at the end of the nineteenth century and during the first decades of the twentieth century (Tecnica, Caberlotto, Calzaturificio Alpina, Dolomite, Munari and Nordica). In fact, half of the founders of the district have successfully remained active on the market even after the third generation (Durante 1997). As for the foreign-owned firms, some multinationals (MNCs) entered the cluster during the 1970s, such as Salomon which acquired S. Giorgio; Nike, which acquired Bauer; and HTM (Head, Tyrolia and Mares) which acquired Brixia S. Marco and Munari. In the 1990s also Benetton—an Italian-owned company originated in the region of Veneto—started a process of local firm acquisition by buying Nordica. After a few years, Benetton withdrew. Within the cluster, it is possible to observe the presence of local agents/actors such as technological centres, chamber of commerce, local trade unions, entrepreneurial associations and the Foundation Museo dello Scarpone di Montebelluna, a specific local organisation managed by a lively director who organises several local activities (training, information exchange through firm networking, conferences, etc.). Thanks to Nordica's technological revolution in 1966 consisting in the introduction of plastic in winter boots, in the 1980s the Montebelluna cluster became the most important international centre for the production of winter shoes and boots. It has been estimated (Corò et al. 1998) that, from the 1980s to mid-1990s, 75% of the world market of ski boots, 65% of after-ski, and 80% of motorbike boots were produced in this area. The GDP per capita in the province of Treviso is 22,064 Euros, and there is a plant every nine inhabitants. The levels of unemployment are particularly low with respect to the national average.

After World War II and during the 1960s, the Montebelluna entrepreneurs started to modify the ski boot rendering it more stable on the ski and more robust. In fact, they introduced a steel plate on the sole and a new blockage system. In 1962, the boot with the metal lever appeared for the first time, promptly adopting an innovation appeared in Switzerland. This was a minor innovation which offered a much better closure compared to the traditional shoelaces. In the same period, the vulcanisation of the sole was introduced, a method that joined the sole with the upper; then, the PVC injection method was introduced, which is a more rapid system to link the sole and the upper. During the 1960s producers sponsored a wide standardisation of products, components and ski binding. In 1967 Montebelluna experimented the first models of boots with plastic-covered leather.

The real big technological revolution had followed the creation of a new technological system patented by Lange in 1964 in Colorado. In fact, Lange—which presented its first exemplar of plastic boot in the US exhibition—was not able to produce a really workable boot that could be manufactured for the mass market. Its invention was in fact refined in Montebelluna by Nordica, which substituted the Lange fusion with the injection method, combining the machinery competences of a firm located in Padua (the Lorenzin firm), an injection producer for rubber sole, and the knowledge of a trader of plastic raw materials, local agent of Bayer. This innovation was a game changer for the industry; Lange himself opened a factory in Italy near Montebelluna in order to have access to the modified technology and to the technology suppliers already well developed in the nearby area.

During the 1960s and 1970s, the firms in the district continued their stable growth, and the production of ski boots shifted from 180,000 in 1963 to 1000,000 in 1970 and to 4,100,000 in 1979. Many of the historical firms adopted the new technology (Nordica, Dolomite, Munari, S. Giorgio and Tecnica), while many others, which did not believe in these novelties (or that did not have the necessary funds to reorganise their productive cycle), started to diversify into new products (sport shoes, leisure shoes, etc.). Final firms built their design competences in connection with a design school based in Vigonza, near Venice, a school founded by entrepreneurs of the Riviera del Brenta District. The school is now specialised in training fashion designers and CAD-CAM experts.

The second relevant diversification was the introduction of the after-ski boot in plastic material. The first model was the Moon Boot by Tecnica (1970) which was inspired by the astronauts that in that year flew to the moon. In a few years, the production of after-ski items took off. At the end of the 1970s, Montebelluna was producing about 7.5–8.0 million pairs of this new product.

The third diversification was in sport shoes such as jogging, ice and roller skates, basketball, football, motocross, dancing, cycling, tennis and leisure shoes. The overproduction of the 1980s created a typical firm shake-out, with the exit of some important producers of the district. However, new products (with the fourth productive diversification) substituted the decline of the demand for the more traditional production. In the subsequent period, during the 1990s, new products such as trekking, snowboard, in-line skates, football shoes and sport shoes for walking (city shoes) were adopted or created. During the 1990s two local leading firms emerged: Geox and Stonefly. In 2010, Geox's sales represented 40% of the total district (2 billion Euros). In the last years, the delocalisation processes have reduced very much the local employment in footwear firms, but an increase was observed in the number of firms with FDI (Belussi 2010).

The district can no longer be described as a classical example of canonical (Marshallian) industrial district. In fact, the district has undergone a process of dynamic evolution which is not explained by the existence of externalities but by a localised process of learning and innovation that has very much created a wide heterogeneity of high-performing firms, giving rise to the forming of a group of diversified leading firms of medium-large size (Osem 2001). This process of hierarchisation has also occurred in other Italian clusters (Belussi and Sedita 2009; Bellandi et al. 2010). Official data on export trends of the province of Treviso show that in 2001, local firms exported about 430,292,000 Euros towards Romania (ISTAT Data 2002). Such data register all the operations for supplying components to Romanian subcontracting firms and correspond to about 35% of the total output produced in the Montebelluna district with reference to the shoe and sport clothing segment. In the last years, new producers from Northern Europe, Canada and the USA have entered the sportswear business.

The two largest firms in the district are Geox and Tecnica. Tecnica acquired a famous Austrian company—Lowa—in 1993; then, a Montebelluna firm, Dolomite, in 1998; then Nordica in 2002; and then Rollerblade, in 2003, the US company owned by Benetton; and finally in 2006, Tecnica acquired Blizzard. When firms recur to offshoring, they develop in-house the tertiary function of design, management, logistic and research. In fact, we can observe that in Montebelluna, about 66.3 of employees are qualified. Also many unskilled workers are employed in the service function of shop assistants (Table 4).

Considering that the firms interviewed employ 5589 workers locally, employment related to foreign plants has been estimated at 7372 working units (AIDA Bureau Van Dijk 2013). Thus, Montebelluna firms (and in particular Garmont, Grisport, Lotto Sport, Tecnica, Scarpa, Alpinestars and Geox) manage a larger number of employees outside the cluster. In an effort to raise its reputation in the US, Garmont North America has recently relocated its commercial facility from Vermont to Portland, an American footwear cluster originated around the well-known Nike company.

7.1 Economic Characteristics of the Firms Interviewed

The Montebelluna cluster has already reached the phase of maturity, if not stability-decline. However, despite the global crisis of 2008, in the last 5 years, about 40% of the final producers have increased their sales, while all producers of components have declared to be in a phase of stability or decline. During fiscal year 2011, the firms interviewed produced about seventy million pairs of shoes, corresponding to an aggregate value of sales of about 2.6 billion Euros. Producers of components earned 35 million Euros. The average price (in factory) of shoes produced is extremely high: 72.2 Euros, with a range of variation between 140 Euros and 30 Euros. Data on prices suggest that firms in Montebelluna produce a very costly product and that they are inserted in a high-quality niche (the technical market of sport shoes). Firms' export flows are very large (Table 5). On average, footwear firms export 63% of their sales abroad, while producers of components do not export. Export flows cover all industrialised and emerging countries. Moreover, 70% of firms produce with their own brand, and only a minority fall within a mix category producing with their brand and with that of their clients; four firms are only subcontractors that work for external orders coming from national and international firms (Table 6).

As for the organisation of the production cycle, only 36% of all firms perform manufacturing and assembling internally, as well as logistics, sales and marketing. In 40% of the cases, local firms manufacture only prototypes in the cluster (Table 7). These latter firms are among the largest and more technologically advanced of the cluster. They built their global supply chains during the 1990s, relocating some manufacturing activities abroad.

7.2 Relationships with Subcontractors and Main Competitors

The firms interviewed declared to work with 233 subcontractors. The local subcontractors located in the cluster are 147, and foreign subcontractors are 87 (Table 8). Firms operating with subcontractors are 83.4% of our sample (25 firms out of 30). On average, each firm deals with 7.7 local subcontractors and with 4.2 foreign subcontractors. Therefore, the Montebelluna cluster is no longer a self-contained Marshallian district, but it is fully inserted in global supply chains. Firms have a partnership type of relation with local subcontractors (this happens for 62% of the firms interviewed). On the contrary, the relationship with foreign subcontractors often develops on the basis of pure market transactions (Table 9).This introduces a behavioural bifurcation in a typical Marshallian district.

When considering the final product, there are several sub-filières in the cluster, but many final firms share the same specialised subcontractors. Machinery, component and mould producers are localised mainly in the Montebelluna area (Table 10). Within the cluster, there are many lateral linkages with complementary industries (plastic, mechanical machinery, moulding) and with the related sectors of commercial distribution. In many firms, the only activity performed is design and prototype production, while assembling is performed in foreign low-labour cost countries. High-quality and low-volume products are generally subcontracted to local firms.

This cluster is particularly competitive at international level, with the main competitors all originating from the cluster itself. Notwithstanding that, some Middle East producers and Taiwan-Chinese firms are now starting to be perceived as potential rivals (Table 11). The absence of trade barriers against imports from China has damaged district firms and—according to some entrepreneurs—has caused the closing down of many local subcontractors now replaced by cheap local firms run by Chinese people.

In a few years, frontier firms (Andrews et al. 2015) and global supply chains run by MNEs (such as Nike,[10] Adidas and Puma) have outperformed Montebelluna's leadership in sport shoes. They have hugely invested in R&D, advertising, marketing and sponsorship of athletes. On the other hand, it is also necessary to consider that during the 1990s, fast-growing Asian subcontractors became impressively large-scale firms, offering Western brand producers, as well as the large firms of the Montebelluna districts, low-cost manufacture of subcontracted items.[11] In Montebelluna, the only fast-growing firm in the last decade has been Geox which, in the last years, reached a sales threshold of nearly 1 billion Euros (the value includes the foreign firms controlled by Geox). However, Geox, which is the largest firm in Montebelluna cluster, is a dwarf compared with Nike (24 billion dollars sales in 2011 and 44,000 employees) or with similar competitors.

Currently, firms in Montebelluna are surviving or slightly growing thanks to the adoption of complex low-volume, high-tech and high-value strategies.

7.3 Level of Innovativeness of the Montebelluna Cluster Firms

The strong international success of the Montebelluna district is explained by the intense innovation activity going on among the local firms. Montebelluna is now a typical knowledge-intensive cluster. The following are some interesting survey results. In 19 out of 30 firms, an endogenous innovation activity is visible and highlighted by the presence of R&D laboratories. Innovation activity in the cluster is measurable also in terms of innovation output, namely, through the number of international patents registered by the local firms. Moreover, 18 firms have registered patents in the EPO data base. However, some large firms are also performing R&D in foreign countries, such as Alpinestars that own a subsidiary unit in California with about 80 scientists and engineers. On average, in our sample, the expenditures on R&D cover 2.3 of sales. The footwear cluster firms interviewed usually develop original products as well as new technologies in machinery and in design (Table 11).

[10] It is important to note that in the USA, in Portland, (in the State of Oregon), Nike has given rise to an American cluster of 300 firms (final firms and subcontractors), 3200 self-employed workers and consultants and 14,000 workers. It has been estimated that the average annual salary in Portland is about 82,700 dollars. Clearly, though, local workers are employed only in high-tech or high-value functions. Adidas (which was bought in the last years by a former manager of Nike) recently moved its commercial American headquarters here.

[11] An example of these fast-growing Asian firms is represented by the case of the Tsai family that in 1988 founded in Hong Kong Yue Yuen, a firm that in 2011 produced 326 million pairs with sales amounting to 7 billion dollars (with 460,000 employees) and that has opened new factories in China together with a retail shop chain (called Pou Chen).

Only seven firms are focused on adapting and redesigning existing designs of other firms (mainly Italian, but also some foreign firms). Considering the collection of the last 2 years, the percentage of new models introduced is very high: 59.6%. This is confirmed also by the indicator referred to the number of new products introduced in production every year, weight on sales. For the majority of the sample (96.6%), technologies in product (CAD) and processes (machinery) come from the local market (Table 12). Thus the strength of this cluster relies in the capacity to feed local firms with the endogenously produced technologies. Local technologies are often (46.7% of the sample) complemented with foreign high-tech technologies coming from Europe and the US. The use and investments in ICT by the interviewed firms is quite high. ICT in management is largely adopted (3.77), particularly in order to connect clients and suppliers (3.70).

On-the-job training is a very common practice among the firms of our sample, but also more articulated forms of learning (use of consultants and supervisors) are frequently adopted. Only five firms declared to be imitating their main competitors. Considering more formalised forms of learning, we found internal training, external training and a wide use of benchmarking activities. In few cases firms used the participation in institutional projects and initiatives promoted by local and/or industry associations and visited "best-practice" companies (Table 14). The three most important sources of information on new technologies indicated by our interviewees with nearly equal weight are (a) international exhibitions or conferences (with a weight of 3.57 on a 1–5 scale), (b) local subcontractors (3.20) and (c) and international clients (2.97). Local knowledge spillovers in the cluster appear to be important, but also the cluster's openness and the external linkages created by the participation in foreign exhibitions or the use of international subcontractors (2.77) and international partner firms (2.60). Local competitors are still an important source for creating the cluster's competitive advantage. This is because local competitors are in fact international leaders. Local institutions, business associations, universities, private service providers, local service centres or partner firms now play a very marginal role. Perhaps they were more important in cluster's take-off phase (Table 15).

As for the sourcing of information on fashion trends, firms use journals and specialist magazines (with a score of 4.93 on a 1–5 scale), the Internet (4.87) and international sectoral exhibitions (4.40). Also travels are important, both national (3.57) and international (3.57). To conclude, important linkages are both internal- (local competitors and subcontractors) and external-to-the-cluster (international competitors, clients, partner firms, subcontractors and exhibitions) (Table 16).

8 Some Conclusions: Turkish and Italian Footwear Clusters in Comparison

Our analysis compared four footwear clusters in different stages of their development. In both Turkish and Italian clusters, ancient manufacturing traditions constituted the base for the development of a specialised industry, which is largely based on small-sized firms run by local entrepreneurs. And again, in both Turkish and Italian cases, the growing internal market was very important and particularly the youngest generations' demand. As we have mentioned before, the internal market is still very much important in the Turkish case, much more than what happens in the Italian case. These similarities between Turkish and Italian footwear clusters, as well as other aspects that characterise the clusters, could suggest that the former are somehow replicating (with the necessary changes) an evolutionary path of growth already experimented by the latter in the past, during the 1980s and 1990s. However, important differences characterise these clusters: firstly, the fact that many firms in Montebelluna operate in high-value niches, which dive them some market power. The average price in Euros for shoes is higher for the technical shoes of the Montebelluna cluster (70.7) and lower for the more traditional products made in Konya (23.5), Izmir (35) and Istanbul (43.2). Secondly, in the Turkish clusters, the production is primarily organised for the domestic market, while in Montebelluna, the target market is (mainly) international. Indeed, Montebelluna firms export 74.5% of their sales, while in Konya, Izmir and Istanbul, this percentage is much lower (14.6%, 24.6% and 32.4%, respectively). Thirdly, firms' innovative capacity is very different, with the Turkish firms producing almost handmade shoes and the firms in Montebelluna producing high-tech materials and techniques. Another relevant difference obviously relates to the average cost of labour in the four clusters. In the Turkish clusters, labour costs per hour are around 15TL (Turkish lira), thus, about 4 Euros, while in Montebelluna they are about 30 Euros. The average salary for a skilled worker in Montebelluna amounts to 1500 Euros and only 750 in Istanbul.

In Montebelluna, an important source of innovation lies in the fact that technologies and components come from the local market and only for 22.7% from abroad. Firms in the district are very innovative, and new technologies and innovation are produced here. On the other hand, Turkish firms are mainly imitators and acquire their technology from Italian producers. In all clusters, firms have direct access to the different information and knowledge sources.

In Turkish clusters, manufacturing activities are still very important (Eraydin and Armatli-Köroğlu 2005). Most companies perform all manufacturing and assembly phases internally. The inter-firm division of labour is low, and subcontracting involves not only specialised parts but also finished products for large retail chains, thus volume-subcontracting. In the case of Montebelluna, firms have outsourced the manufacturing phases to foreign countries or have created their own manufacturing plants abroad (particularly in Romania). In the Montebelluna cluster in particular, firms have relevant investments in ICT for management and commercial purposes.

These differences create different conditions for cluster development. Indeed, the comparison among clusters in the different stages of development paves the way for a reflection on the key factors that trigger cluster evolution. Both in the Turkish and in the Italian clusters, the presence of district-like features recognised as part of the "Marshallian atmosphere" (Belussi 2015) has been an important lever for cluster emergence, as well as for the first stages of cluster development. In these initial stages, cluster external economies and the driving force of demand (the domestic one in particular) have stimulated entrepreneurship and creativity. However, after these early stages of development, Montebelluna and Istanbul have continued to grow, while the other two clusters have failed to progress. An important factor that enabled the first two clusters to evolve over time is given by the presence of leading firms acting as bridges with external markets, knowledge and external technologies connecting local value chains with global value chains (Belussi 2010, 2015). Thus, factors important in the initial stage explaining agglomeration, relevant for locating and for staying in the cluster, are no longer important in the maturity stage to trigger growth (Boari et al. 2016; Tödtling et al. 2017; Pandit et al. 2017; Hervas-Oliver et al. 2017). This is clear in Montebelluna, which has a longer history than the other clusters. However, even in Turkey's case, the cluster characterised by the presence of leading enterprises is the one that experienced the strongest growth. In the Turkish case, leading firms operate beyond the boundaries of the single cluster, because leaders are organisers of national supply chains that stretch out on all Turkish clusters' footwear. In addition, leading firms in Turkey have direct access to the market, through their own shops. Albeit their international activity is still relatively limited, leaders in Istanbul are increasing their productive and commercial activities abroad, including experimenting the FDI strategy (in the Zylan case). However, Turkish leading firms are still few, and, at the moment, it is unclear whether they will continue to drive growth throughout the local system.

In Turkey, the growth of these business leaders—as well as that of the entire footwear industry—was supported by protectionist policies adopted mainly against Chinese products (Karacaovali 2011). These interventions seem to have been effective in supporting the whole manufacturing system, whose growth prospects are positive. However, new type of policies are needed, capable of supporting innovation, improvement of environmental conditions and workers' safety. Public investments in design and innovation could be promoted, including scholarships for studying in top design schools based abroad, in European countries or in the USA.

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New Roles for Supporting Organizations in Clusters: Enhancing Connectedness in Knowledge Networks

Jose Antonio Belso-Martinez, Maria Jose Lopez-Sanchez, and Rosario Mateu-Garcia

Abstract In today's context of economic crisis, certain structures such as industrial clusters have been forced to change in order to remain competitive. For years, local supporting organizations have been focused on strengthening cluster networks, providing specialized services, and fostering innovation practices. Nowadays, thanks to their increasing connectivity, supporting organizations have become hybridizers and catalyzers of knowledge that spreads among local firms after an intense process of refinement. Acting as mediators between local firms and gatekeepers of extra-cluster knowledge, they smooth firms' access to fresh knowledge and nourish the innovativeness of the system. Using data collected in the Toy Valley cluster during 2014, this chapter looks at the mechanisms allowing supporting organizations to successfully diffuse knowledge and pays attention to these two in-between positions. In line with previous research, findings corroborate the particular relevance of facilitators of knowledge. However, important differences emerge when considering the profile of the local organization and the type of knowledge shared.

Keywords Clusters · SME's · Supporting organizations · Networks · Gatekeepers

1 Introduction

The sharing of experiences across organizational boundaries creates opportunities for transferring knowledge and, subsequently, stimulates knowledge production and innovation (Inkpen and Tsang 2005; Phelps et al. 2012). Strategically important positions within networks, where knowledge is exchanged, allow organizations to better access external knowledge sources (Buckley et al. 2009), facilitate common learning processes (Schoenmakers and Duysters 2006; Nooteboom 2008), and improve performance (Zaheer and Bell 2005; Shipilov and Li 2008).

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In-between positions connecting two different actors that otherwise would not have a relationship are one of those strategic locations in a network (Burt 1997; Ahuja 2000; Zaheer and Bell 2005; Hargadon and Sutton 1997). This intermediary or brokerage situation enables privileged access to information transferred between unconnected partners and opportunities for arbitrage and better capitalizes on existing capabilities (Burt 1997; Hargadon and Sutton 1997; Zaheer and Bell 2005; Shipilov 2006). Accordingly, brokers emerge as facilitators of knowledge transfers (Nooteboom 2003) and innovators that recombine external knowledge to create novel solutions (Hargadon 1998; Verona 2006).

The knowledge-based theory of industrial clusters (Maskell and Malmberg 1999; Maskell 2001) describes them as concentrations of firms and supporting organizations (also labeled as institutions) in which geographical co-location fosters face-to-face interactions and knowledge creation (Dahl and Pedersen 2004). Although place may matter for knowledge creation and exchange (Audretsch and Feldman 1996), connectedness with other local actors seems to be the pathway for acquiring the knowledge and competencies within these spatial agglomerations (Lazerson and Lorenzoni 1999; Boari and Lipparini 1999; Munari et al. 2012; Giuliani 2011).

Not all cluster members build knowledge linkages to the same extent. In fact, cluster members largely differ in terms of both linkages and position within the network (Giuliani and Bell 2005) and unevenly participate in local knowledge exchanges (Giuliani 2007; Morrison 2008). Due to the particularities of their portfolio of linkages, intermediaries within these innovation systems accomplish functions of knowledge creation, transformation, and transmission (Howells 2006) whose loss would greatly affect the systemic survival. Supporting organizations are locally oriented entities such as business associations, universities, or technological institutes that provide firms in the area with a host of collective services. In addition to providing advanced services, these local organizations also act as knowledge intermediaries or brokers that compile and disseminate knowledge and reduce search costs for individual firms (McEvily and Zaheer 1999). By developing this function in certain regions, local organizations offset the lack of large firms that frequently perform this role too (Kauffeld-Monz and Fritsch 2013).

While intra-cluster mediation allows cluster members to learn easily and continuously through recombination of knowledge (Molina-Morales et al. 2016), extra-cluster connections are crucial for the acquisition of new knowledge which is critical for the long-term survival of the cluster (Bathelt et al. 2004; Wolfe and Gertler 2004). Firms or local organizations with strong connections outside the agglomeration, which identify trans-local novel ideas that once combined with local knowledge (Graf and Krüger 2011; Munari et al. 2012), are disseminated within the cluster (Morrison 2008; Graf 2011; Giuliani 2011; Munari et al. 2012). Either cluster firms (Morrison 2008; Giuliani 2011) or local supporting organizations (McEvily and Zaheer 1999; Molina-Morales 2005; Kauffeld-Monz and Fritsch 2013; McDermott et al. 2009; Clarke and Ramirez 2014; Lee et al. 2010) can potentially perform as knowledge gatekeepers of the cluster to hook onto the global innovation system and circumvent lock-in risks.

Probably blinded by firm-level benefits, the contextual specificities of clusters or the implications for upgrading local capabilities (Clarke and Ramirez 2014) concomitant with mediating positions, scholars have relatively left aside other realms of analysis (Stam 2010). In this vein, notwithstanding the value of prepublished contributions, the benign effects of the mediating role of supporting organizations are still subject to controversy as their effects remain diluted among different factors (Molina-Morales and Martínez-Cháfer 2016). This chapter refines our comprehension of the brokerage phenomenon in clusters by exploring the relevance of supporting organizations as intra-cluster brokers and their propensity to bridge the local and the global sphere. By quantitatively comparing cluster supporting organizations and firms, we elucidate the foundations and mechanisms underlying the different processes facilitating or curbing knowledge flows from local and nonlocal repositories of knowledge. Furthermore, we also extend current literature by controlling the implications induced by the characteristics of different knowledge flows (Alberti and Pizzurno 2015).

Data collected in the Toy Valley in the Valencia region (Spain) using roster-recall methodology and social network analysis corroborate the prevalence of local supporting organizations in knowledge mediation activities. Findings also reveal that not all these organizations broker knowledge to the same extent due to the specificities of each organization and the characteristics of knowledge shared. After this introduction, we present the theoretical framework. Then, the context of the investigation, the methodology, and the results of the analysis carried out are described. Finally, the conclusions are discussed, and the main limitations and potential future lines of investigation are presented.

2 Theoretical Framework

Clusters are agglomerations of related firms and supporting organizations where a strong overlap of the territory and interorganizational linkages exist. Within clusters, actors use different networks (Alberti and Pizzurno 2015) or interact differently (Sammarra and Biggiero 2008) depending on the knowledge shared. Previous research has clearly distinguished between technical knowledge and business information networks (Giuliani 2007; Balland et al. 2016). Morrison and Rabellotti (2009) relate the configuration of each network to the degree of codification of the knowledge shared. In their analysis of the Barletta footwear cluster, Boschma and ter Wal (2007) reveal when complex knowledge prevails, networks become more selective, less dense, and higher in reciprocity.

Either technical or business knowledge is not in the air (Giuliani 2007) but flow through intra-cluster relational architectures. So, firms and supporting organizations do not access valuable information by passively locating operations in a cluster. A significant level of embeddedness in the local network is needed to successfully share or transfer knowledge. Well-connected cluster central actors have a varied portfolio of knowledge sources at their disposal; however a minimum threshold of absorptive capacity is needed to assimilate and apply the potential knowledge assets (Giuliani and Bell 2005).

Strategic positions in the cluster network, overall centrality, depend on the actor's attributes and brokerage roles (Vicente et al. 2011). Even in mature clusters, both centrality and brokerage positions in tacit or explicit territorialized networks significantly affect innovation (Casanueva et al. 2013). A network actor in a brokerage position connects two unrelated partners and spans the structural hole between them (Burt 1992). When bridging unilateral ideas from two independent organizations, the broker absorbs knowledge and boosts its dissemination within the system (Hargadon and Sutton 1997; Hargadon 2002). By internally recombining the acquired knowledge and spreading more polished knowledge, brokers reinforce both the cluster and their own innovation potential. To do so efficiently throughout the cluster life cycle, the organizational skills of intermediaries evolve as firms in the cluster assume a broader range of practices (Clarke and Ramirez 2014).

Using different context and alternative grouping criteria, previous research has identified different brokerage structures and the implications derived (e.g., Lissoni 2010; Kirkels and Duysters 2010; Belso-Martínez et al. 2015). Most of this research relies on the idea of brokerage behavior as a facilitator of information flows. In their seminal contribution, Gould and Fernandez (1989) recognize non-exclusive brokerage categories depending on different configurations of group membership among the three actors involved. In general, this typology assumes that information that flows within a homogenous group should be distinguished from flows between groups.

Cluster actors can play one or more brokerage roles, especially if various types of knowledge that are selectively exchanged through different flows are considered. Following the methodology suggested by Gould and Fernandez (1989), cluster literature has frequently categorized brokerage based on firms' position within the local value chain (Belso-Martínez et al. 2015; Boari et al. 2016), differentiating between firms and diverse supporting organizations (Alberti and Pizzurno 2015) or splitting the population into two strata with location inside or outside the cluster (Vicente et al. 2011).

Some of this research shows how government agencies and supporting organizations act as mediators fostering cluster development (Mesquita 2007; Gagné et al. 2010). Their role as facilitators has been addressed, not only by innovation researchers (Howells 2006; Kirkels and Duysters 2010) but also by sociologists (Smith-doerr and Powell 2005) or geographers (Schamp et al. 2004; Morrison 2008; Giuliani 2011). The focus of their activities is generally on improving the cooperation atmosphere by building trust. As facilitators, local associations and knowledge organizations establish a flow of information, ideas, and resources within clusters (Gagné et al. 2010) and provide new knowledge to innovate (Molina-Morales 2005).

Evidence from the Boston biotech cluster points out that supporting organizations frequently act as coordinators, conveying knowledge between local firms (Owen-Smith and Powell 2004). In their analysis of the regional innovation systems, Kauffeld-Monz and Fritsch (2013) prove that public research organizations are profoundly involved in knowledge exchange process and possess central (broker) positions within the regional innovation network. More recently, Molina-Morales and Martínez-Cháfer (2016) show that supporting organizations are relevant intermediaries of knowledge in the Tile cluster of Castellon and provide evidence of the benefits they generate.

Further than mediating locally, cluster actors may also act as gatekeepers connecting the local buzz and the global pipelines (Bathelt et al. 2004; Montoro Sánchez and Díez Vial 2016). By doing so, they introduce external novelties into the system, enable new knowledge production, minimize risk of lock-in (Molina-Morales and Expósito-Langa 2013), and induce cluster renewal (Hervas-Oliver and Albors-Garrigos 2014; Molina-Morales and Expósito-Langa 2013). Although leader firms frequently play this role of gatekeepers of knowledge (Morrison 2008; Giuliani 2011; Randelli and Lombardi 2014; Giuliani and Bell 2005; Munari et al. 2012; Graf and Krüger 2011), supporting organizations can also exert external effects on the innovation system. In fact, they serve the functions of a gatekeeper to a greater extent than private actors (Graf 2011; Kauffeld-Monz and Fritsch 2013) and are crucial in lagging regions that suffer a lack of large firms.

3 Methodology

3.1 The Context

3.1.1 The Toy Valley in Perspective

The heart of the toy sector in Spain is in the Valencian Community where 41.3% of jobs and 38.4% of total sales are concentrated. Approximately, 88% of the Valencian companies agglomerate in the Toy Valley, specifically in the cities of Ibi, Onil, Castalla, Tibi, and Biar. Manufacturers are usually family-owned and small in size. The geographical concentration of related productive activities and the tight linkages between socioeconomic actors allowed previous research to identify this area as a Marshallian industrial district (e.g., Boix and Galletto 2006).

The origin of the Toy Valley cluster dates back to the late nineteenth century; when influenced by external stimuli, some families brought their experience and knowledge acquired through handicraft occupations to start producing dolls, miniatures, or small cars. Progressively, a solid industrial atmosphere surrounded the area, and outdated manufacturing practices were replaced. During the 1960s and 1970s, the cluster underwent intense development which favored an accelerated accumulation of resources and strong spin-off dynamics.

The following decades witnessed a decline in the average number of workers per firm and the acceleration of outsourcing practices. In line with other Valencian clusters, economic perspectives deteriorated due to fierce global competition and the erosion of traditional competitive advantages (mainly based on labor costs). This decline slowed in the 1990s after an intense reorganization of the system in which many flagship companies disappeared because of scarce flexibility. Technological innovations and the fragmentation manufacturing processes materialized in a compact population of firms, tightly linked in cooperative networks.

Four key factors determine the cluster's current situation. Firstly, even the programs implemented, toys sales remain highly seasonal. Secondly, the spiraling competition from low-cost producers has widely reduced the market share of traditional Spanish toys. Thirdly, new market trends show preference for electronic gadgets in general. Fourthly, opportunism and irregular practices have become a major problem. Cheap imitations or unsafe products from Asia are having a detrimental effect on the track record of many local manufacturers.

3.1.2 The Toy Valley: Systemic Structure and Supporting Organizations

The systemic structure is complex. As Fig. 1 shows, a wide variety of networked organizations operate from different perspectives and close cities. For decades, in line with the "Marshallian" tradition, co-location fostered cooperative relationships and a climate of trust among the different actors (Hernández Sancho 2004; Ybarra Pérez and Santa María Beneyto 2006). However, both local and particularly international sourcing have turned out to be major strategies (Belso Martínez and Escolano Asensi 2009). The openness of local manufacturers assuming the inherent transaction cost has also favored the acquisition of extra-cluster knowledge and diminished the potential risks of cognitive lock-in (Hervás Oliver et al. 2015). Figure 1 shows how manufacturers interact with nonlocal actors by maintaining trade or regular information flows with suppliers located in different regions or economic sectors.

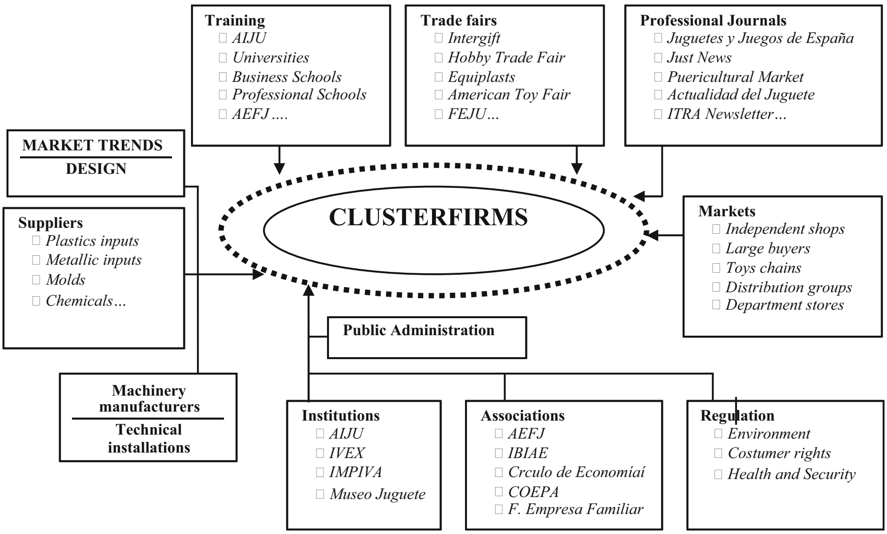

Fig. 1 The Toy cluster environment

In particular, many local supporting organizations have also increased their extra-cluster linkages (see Table 1 for a comprehensive list and description of the cluster organizations). Most of their objectives relate to the "Marshallian" tradition such as R&D, consolidation of local networks, professional training, or specialized services. However, growing efforts devoted to scrutinizing and interacting in the global arena have enhanced their role as catalyzers and hybridizers of novel knowledge that is subsequently diffused within cluster boundaries. Just like in other clusters (Molina-Morales 2005; Molina-Morales and Martínez-Cháfer 2016), once the potential

Table 1 Main supporting organizations within the Toy Valley cluster

	Nature	Fields	Activities
Univ. Miguel Hernandez (UMH) Univ. Politecnica de Valencia (UPV) Univ. Alicante (UA)	Public center. Multisector higher education and research	Technology and management	Training, scientific research projects (national and international)
Instituto Formacion Profesional (Vocational training center)	Public center. Training on technical and design for the toy sector	Technology and design	Secondary and professional schools. Specialized focus on the local labor market
Instituto Tecnológico del Juguete (AIJU) (Technical Institute for Toy-making")	Public entity. Research and technological innovation for the toy industry	Technology and design	Training, technological research, toy and material tests. Products and market analysis
Asociación Española de Fabricantes de Juguetes (AEFJ) (Spanish Association of Toy Manufacturers)	Private. Defending and promoting interests of the toy industry	Promotion and management	Support on specific issues like training, cooperation, and environment
Asociación de Empresarios de Ibi (IBIAE) (Business Association of Ibi)	Private. Promoting interests of local companies of different sectors	Promotion	Provide support on training, business information cooperation, and environmental issues
Cámara de Comercio, Industria y Navegación (Chamber of Commerce, Industry and Navigation)	Public. Promoting local companies of different industries	Promotion	Promotion (especially international), defending industrial interests, research projects, training, and information
Agencia de Desarrollo local (ADL) (Local Development Agency)	Public. Promoting the local economic and business atmosphere	Promotion	Local development agency. Training, labor mediation, self-employment, career guidance
Fundacion Crecer Jugando (*Crecer Jugando* Foundation)	Private foundation. Promoting the industry through children's rights	Promotion	Defense of the fundamental right to play as one valuable activity for children

advantages of opportunities that exist beyond the district's borders had been evaluated, they have become transmitters of this technical and managerial knowledge at the local level.

AIJU and AEFJ have exemplified the abovementioned activities. By providing specific services at reasonable cost, AIJU still plays a pivotal role actor in the construction of firms' and systemic capabilities (Holmström 2006). Additionally, it serves as a valuable repository of novel knowledge and fosters innovation by assisting in spheres such as product development, manufacturing, or training. AEFJ has also contributed decisively to local competitiveness and innovation. In addition to providing a variety of services (legal assistance, institutional representation, or training), the business association represents a real forum where valuable managerial experiences are diffused within local firms. Besides, several projects have transformed AEFJ into a real guiding star for the development of new products or the identification of market trends. The launch of Spora, a specialized site that brings together all the creative potential generated by designers and supporting organizations with the purpose of being disseminated among toy firms, should be particularly mentioned.

3.2 Data and Measures

We developed a questionnaire on the basis of previous literature (Giuliani 2007; Morrison and Rabellotti 2009) and eight in-depth interviews with relevant local manufacturers, researchers, and institutions. Our tool tackled different aspects such as the firm's characteristics, innovation practices, interorganizational relationships, and economic performance. The preliminary questionnaire was only slightly modified as few problems were encountered during the pretest pilot. To collect network data, "roster-recall" methodology was applied. Each interviewee was asked to select from an open list of local firms and supporting organizations from which technical or business information was received.[1] Additionally, participants were invited to include other firms not listed from whom technical advice or business information had been obtained.

To guarantee accuracy of responses, a local technician largely involved in the toy industry and innovation programs administered the questionnaire to top-level managers and business owners through a 45–50-minute face-to-face interview. At the beginning of each meeting, the benefits of the project were explained, and confidentiality was guaranteed to encourage accuracy in the replies given (Eisenhardt 1989). Strong interest of informants guarantees the accuracy of records, so access to final results was offered an incentive (Miller et al. 1997).

[1] The respective questions read as follows: (a) To which of the following firms on the list did you regularly ask for technical advice? (b) To which of the following firms on the list did you regularly ask for business information?

At the end, a total number of 85 firms and supporting organizations located in the Toy Valley are accepted to collaborate during 2014. This yields a response rate of 95% on the total population identified from reliable databases (SABI, AIJU, and AEFJ). Toy manufacturers accounted for 39%, while suppliers and local organizations represented 49% and 12%, respectively. Peer debriefing by AIJU experts confirmed that all relevant players were considered and missing actors were very scarce.

Since relational data collected refer to two different networks, we organized them into two matrices composed of 85 rows and 85 columns, corresponding to the number of firms and local organizations in the cluster. The cells in the matrix show 1 for the existence of a tie between actor i in the row to actor j in the column and 0 otherwise. The matrices are asymmetric, given that the transfer of knowledge from actor i to actor j may not be bi-directional.

To test the mediating behavior of the surveyed firms and local organizations, we first assume b as being involved in brokerage if i is directly connected to j and g, but j and g are not directly tied (Gould and Fernandez 1989). Additionally, we distinguished three different brokerage scores using four different cluster actors (toy manufacturers, suppliers, supporting organizations, and others).[2]

(a) Coordinator score: counts the number of times an actor i brokers between two unconnected actors, j and g. All three actors belong to the same category.
(b) Interconnector score: counts the number of times an actor i links together two unconnected actors j and g. All three actors belong to different groups.
(c) Global brokerage score: counts the number of times an actor i mediates between j and g, regardless of what group the actors belong to.

In order to evaluate the relevance of extra-cluster connectedness, we use information on the existence of extra-cluster linkages with providers, customers, competitors, consultancy services, universities, public research centers, and private research centers. We created a dummy variable for all different types (1, extra-cluster linkages exist; 0, otherwise).

3.3 Empirical Results

We first computed several indicators such as density, reciprocity, and transitivity (see Table 2). The density of our technical networks, number of ties between firms divided by the total possible connections, reveals tightly knit structures and suggests a quicker flow of resources. In networks, reciprocal relationships exist whenever a tie is connected from actor A to actor B and there is a tie from actor B to actor A. Our

[2]Supporting organizations comprise government agencies, business associations, universities, and technical centers. Suppliers are mainly providers of specialized inputs for the toy industry (e.g., eyes and hair for dolls). The final category, others, amalgamates firms producing nonspecialized inputs (e.g., boxes).

Table 2 Network indicators

	Technical network	Business network
Actors	85	85
Linkages	1379	1362
Density	0.193	0.190
Reciprocity	0.352	0.407
Transitivity	0.434	0.467

reciprocity value, calculated as the proportion of pairs of actors that have reciprocated ties, shows a trend of members to exchange knowledge mutually. Transitivity of a relation means that when there is a tie from A to B, and also from A to C, then there is also a tie from B to C. Transitivity is measured by proportion of transitive triads of actors among all possible triad in the network and indicates existence of stronger ties.

Social analysis techniques were also used to calculate the three brokerage scores for both networks. Once obtained, we applied permutation models for statistical analysis of dependent data and ranked the supporting organizations to statistically observe significant differences between brokerage structures. Permutation tests are a versatile class of statistic procedures in which the distribution of the test statistic is obtained by repeatedly permuting data (5000 times in our case). These procedures are widely used within the field of social network analysis because of their robustness to dependence within the input data (Butts 2007). In addition, analysis of variance was conducted to verify theoretical insights regarding gatekeeper behavior.

Cluster actors were successively divided into two factions, based on their profile, to examine the difference in each brokerage score between the subgroup of interest and the rest. Table 3 displays permutation model results based on the actor subgroup affiliation. Supporting organization presents the highest global brokerage activity in both the technical network (p-value <0.01) and the business network (p-value <0.05). Within the technical network, note that both toy firms and local organizations significantly perform the coordinator role (p-value <0.1 and p-value <0.05, respectively) and the interconnector roles (p-value <0.05 and p-value <0.01). In the business network, supporting organizations, only, coordinate (p-value <0.05), and toy firms interconnect (p-value <0.01) with significantly high frequency. These findings again demonstrate that supporting organizations are the most prominent subgroup among the brokers and thus have the most opportunities for facilitating coordination or transferring valuable resources in the cluster.

Table 4 lists the ten supporting organizations in the Toy Valley ranked by their global brokerage score. Only a few of the organizations have scores that are significantly high across the different types of brokerage in either the technical or the business network. Furthermore, individual organizations show differential tendencies for specific brokerage roles (significance levels are determined using network permutation models). Note that both AIJU and AEFJ occupy all roles in the two networks with a significantly high frequency (p-value <0.01). UA and UPV occupy coordinator positions with a significantly high frequency but do not evidence a relevant interconnector or very scarce global brokerage. “Fundación Crecer

Table 3 Local brokerage: mean, standard deviation, and permutation model results

	Technical network			Business network		
	Coordinator	Interconnector	Global brokerage	Coordinator	Interconnector	Global brokerage
Toy firms	*−0.300 (1.98)	***−0.690 (1.33)	−1.376 (1.74)	−1.045 (1.73)	***0.252 (2.16)	−1.421 (1.79)
Suppliers	−0.754 (1.25)	−1.944 (0.35)	−2223 (0.88)	−0.480 (1.55)	−1.858 (0.439)	−1.617 (0.1.47)
Local organizations	**1.991 (2.54)	**0.565 (4.41)	***3.150 (7.38)	**1.370 (2.81)	−0.287 (5.03)	**1.782 (8.57)
Others	−0.585 (0.00)	−2.369 (0.35)	−2.028 (1.07)	0.519 (0.00)	−2.251 (0.72)	−2.268 (0.75)
Total	0.187 (2.647)	−0.842 (2.104)	0.778 (3.484)	0.285 (2.180)	−0.598 (2.533)	0.843 (3.551)

Significance level: ***<0.01; **<0.05; *<0.1

Table 4 Local brokerage per supporting organization

	Technical network			Business network		
	Coordinator	Interconnector	Global brokerage	Coordinator	Interconnector	Global
AEFJ	***4.115	***5.368	***16.915	***6.509	***12.560	***18.529
AIJU	***2.449	***9.928	***13.073	***2.809	***3.951	***17.102
PROMOIBI—ADL IBI	−0.883	0.777	***7.031	0.342	0.258	*1.607
"Crecer Jugando" foundation	***5.364	***3.284	***6.459	−0.891	−2.602	−2.256
UA	**2.032	0.384	*1.788	***5.687	−2.840	−2.300
UPV	***5.780	−2.818	−2.189	***1.987	−2.840	−2.687
ADL Castalla	***2.449	−2.818	−2.686	−0.069	−2.840	−2.850
UMH	−0.883	−2.818	−2.822	−0.891	−2.840	−3.088
Alicante Chamber of Commerce	0.366	−2.818	−2.973	−0.891	−2.840	−3.118
IBIAE	−0.883	−2.818	−3.093	−0.891	−2.840	−3.118

Significance level: ***<0.01; **< 0.05; *< 0.1

Jugando" is tightly linked to AEFJ, brokers' technical knowledge through the three structures (p-value <0.01). Finally, ADL Castalla achieves statistical significance for horizontal brokerage in the technical network (p-value <0.01). This unexpected result can be explained as it is the only actor providing technical training in this city.

Table 5 displays the results of the analysis of the "gatekeeper behavior".[3] Local supporting organizations attain the greatest number of extra-cluster connections. However, most of their linkages are limited to knowledge-intensive

[3]Values reflect mean differences between the group of interest and the rest of the sample. Only statistically significant positive mean differences are highlighted to ease the interpretation of results.

Table 5 Gatekeeper analysis: descriptive, mean difference, and permutation model results

	Suppliers	Customers	Competitors	Consultancy services	Universities	Public research centers	Private research centers
Toy firms	−0.016	0.057	**0.247	−0.038	−0.127	−0.087	−0.061
Suppliers	*0.104	0.085	−0.147	−0.129	−0.055	−0.027	0.003
Local organizations	−0.007	−0.360	−0.380	***0.453	***0.460	***0.287	**0.160
Others	0.098	0.085	0.378	−0.207	−0.098	−0.049	−0.061
Mean Sd	0.901 0.294	0.918 0.276	0.635 0.484	0.200 0.402	0.094 0.294	0.047 0.213	0.368 0.152

Significance level: ***< 0.01; **<0.05; *<0.1

service providers such as consultancy services, public research centers and universities (p-value <0.01), or private research centers (p-value <0.05). Toy producers and suppliers infuse knowledge from similar ones located outside the cluster (p-value <0.05 and p-value <0.1, respectively).

4 Discussion and Conclusions

Using data collected in the Toy Valley, this chapter adds to cluster literature by thoroughly analyzing brokerage behavior. Generally speaking, our findings highlight that cluster innovativeness is sustained by different knowledge flows in which local actors participate unevenly and selectively. Firms and supporting organizations exchange different types of knowledge in different ways. Additionally, endorsing microlevel polymorphism in clusters, this study verifies that cluster actors perform diverse roles when transferring different knowledge.

Consistent with recent research (Kirkels and Duysters 2010; Alberti and Pizzurno 2015), we demonstrate that brokerage activities are only performed by certain cluster actors, particularly local supporting organizations. At a first glance, our findings also reveal that distinctive knowledge may systematically imply different levels of participation in brokerage. Market knowledge is brokered by a much more reduced set of actors, thereby suggesting more selective knowledge diffusion.

When we examine the supporting organizations group, we see that there are important asymmetries among them. In our cluster, knowledge is mediated by universities, a technological institute, and the toy business association. This suggests that being a broker depends on certain microlevel characteristics. Particularly, as per our qualitative insights, the portfolio of local relationships seems to be a crucial element.

In line with previous research (Alberti and Pizzurno 2015), the prevailing positions of AEFJ, AUJI respond to their capability to mix market and technical knowledge thanks to a wide number of relationships, helping to circumvent potential technological bias (Alberti and Pizzurno 2015). Interestingly, we support the prominence of business associations in brokering any kind of knowledge that will increase cluster competitiveness through the activation of networks and the channeling of resources. This is possible due to the increasing involvement of AEFJ in the innovation field, either directly or indirectly (the “Fundación Crecer Jugando”).

Although limited to coordination and despite their technological focus, universities mediate both technical and business knowledge. On the one hand, this finding implies the existence of specific capabilities to successfully developed businesses. On the other hand, as coordinators, universities possibly acquire and refine knowledge that is later inoculated to cluster firms through other supporting organizations. Furthermore, as per our qualitative insights, this finding also leads us to believe that a certain degree of brokerage specialization exists.

As far as gatekeeper activities are concerned, each group of local actors acts as gatekeepers of a specific repository of extra-cluster knowledge. This finding endorses our arguments about brokerage specialization. Interestingly, cluster actors usually translate and diffuse new knowledge from similar alters located outside. While suppliers or toy manufacturers import knowledge from other producers, local organizations mostly focus their gatekeeper activities on other supporting organizations.

These results have valuable managerial and policy implications. First, cluster actors engaged in innovation practices need access to diverse repositories of knowledge. Managers should design networking strategies to optimize their acquisition or diverse knowledge to innovate. Particularly, linkages with supporting organizations maximize the opportunities to simultaneously obtain both technical and business knowledge. However, care should be taken when selecting potential partners among them, as not all local supporting organizations source knowledge to the same extent. Second, policy makers should conceive programs in view of the asymmetric capacity of cluster actors to disseminate knowledge locally. Partnerships including relevant brokers like supporting organizations or certain firms would be advisable in order to benefit from more recombinable knowledge. In addition, local supporting organizations should consider potential strategies to build extra-cluster relationships with toy manufacturers and suppliers that would engender complementary knowledge flows and synergies.

This study is not without limitations. The analysis concerns one cluster during its maturity stage. Comparisons with systems in other industries and evolutionary stages may generate complementary results and discard potential biases. Longitudinal research based on network data would also throw interesting insights. Our analysis of gatekeeper activities seems limited compared to intra-cluster brokerage. Supplementary research should try to refine and extend these results. Including extra-cluster relationships in the network data would be advisable. Finally, another research path is related to innovative returns provided by each brokerage structure and broker profile. The analysis of potential differences derived from the knowledge shared would also add to present state of the art.

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Part III
Agglomerations, Turnarounds and Recessions

Endogenous Rerouting and Longevity in Systemic Organisations of Production

Marco Bellandi, Lisa De Propris, and Erica Santini

Abstract Recent debate in regional studies has focused on place-based approaches to local development that are associated more and more to the investigation of systemic features able to trigger sustainable innovation paths and resilience against shocks and challenges. This chapter draws on the interpretative arguments related to the endogenous processes of innovation and systemic mechanisms of longevity and long-term competitiveness in industrial districts and local production systems. A critical review of the recent contributions on this topic allows a novel understanding of how—under certain conditions—local production systems can benefit from endogenous rerouting, especially in the face of the recent technological changes strongly impacting on traditional industrial organisations. The activation of latent mechanisms of transition may recombine embedded competences and useful knowledge to deliver path-breaking economic solutions that create new competitive advantages and allow longevity to local production systems.

Keywords Industrial districts and local productions systems · New wave of technological change · Rerouting and longevity

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1 Introduction

In many areas of industrialised countries, economic growth and competitiveness emerged from local models of industrial organisation, such as industrial districts (IDs) and local production systems (LPSs). They were characterised by populations of small- and medium-sized firms, highly specialised in traditional manufacturing sectors (see Becattini 1990; Porter 1998). The analyses of structural change in IDs and LPSs spread across different research fields during the 1990s and early 2000s, aiming at understanding their capability of adjustment in the face of gradual and non-gradual changes or instead path dependency and lock-in conditions (see Grabher 1993; Bellandi 1996). The balance depends on the trade-off between the positive and negative effects of local specialisation in terms of learning and innovative activities (Visser and Boschma 2004; Storper et al. 2015). Knowledge that is specialised and accumulated over time would either favour the adaptation of IDs as evolutionary systems or weaken their adaptability in the face of radical and rapid changes.[1] Indeed, while according to some authors industrial specialisation still plays a key role in economic growth (Storper et al. 2015), the recent debate on the constraints of specialisation has led others to suggest that diversity or 'related variety' (Frenken et al. 2007) might be a better driver of regional economic development in the longer term.

The nature of learning processes and knowledge accumulation within IDs and LPSs has been the object of in-depth analyses (see Becattini et al. 2009; Belussi and Sedita 2012; Lombardi 2003; Menzel and Fornahl 2010). In this relation, Crevoisier and Jeannerat (2009) have introduced the concept of 'territorial knowledge dynamics' as a systemic process that takes place thanks to different components of endogenous and exogenous type. Knowledge in IDs and LPSs is not a datum: various features affect its capacity to face both gradual and rapid changes and to identify multiple path alternatives, including possible switching across renewed development paths (Bellandi and Santini 2017). Contemporary challenges in global markets and technologies may lead to the emergence of a new generation of IDs, as the so-called ID Mark 3 models (Bellandi and De Propris 2015). Here, local structural configurations, strongly related to the inherited identity of the place, and combined with regional, national and global networks, assure customisation and *servitisation*, bringing to renewed opportunities of competitive advantage.

In this chapter, we introduce the concept of *endogenous rerouting* to suggest that the realisation of structural transitions (or *traverses*) may ensure the longevity of socio-economic ecosystems, like an ID and a LPS. The changes are characterised by the combination of many tendencies, internal and external, and the preservation of a strong local identity: *the one in the many and the many in the one* (the motto of Marshall 1919). To explore this issue, Sect. 2 presents the gradual and non-gradual

[1] See the concept of 'rigid specialisation trap' caused by the negative correlation between adaptation and adaptability in path of development of specialised industries embedded into a defined area (Grabher 1993).

sources of instability and the related systemic adjustments which may justify crises as well as changes in IDs and LPSs. Section 3 illustrates IDs' learning processes and the spawning of new know-how nuclei thanks to endogenous processes drawing on the concept of 'useful knowledge' (Kuznets 1965). We explore here processes of knowledge accumulation and the roots of endogenous rerouting in IDs, in particular in face of the new wave of technological change. Section 4 applies this framework to outline endogenous rerouting processes. Section 5 offers some concluding remarks.

2 Gradual and Non-gradual Changes in Mature IDs

During the past few years, the debate about the capacity of LPSs to promote long-lasting development and competitiveness has become more and more relevant, because of several cases of crises in mature IDs (see Staber 2001; Hodson 2008) apparently related also to the challenges posed by globalisation and the recent financial and political shocks (e.g. Martin 2011).

It is worth mentioning that in that debate, different units of analysis were used making it difficult to compare findings (Becattini et al. 2009). Let us recall among such units: IDs with their typical manufacturing specialisation and SMEs prevalence, more general classes of LPSs[2] or other types of local socio-economic ecosystems, if not generic local or regional contexts (e.g. Iammarino and McCann 2006); local SME clusters of main, complementary and subsidiary industries typical of IDs or more generic types of territorial business clusters (see Porter and Ketels 2009; Asheim and Isaksen 2003); referring to either IDs, LPSs or local clusters, various cases distinguished as regard to different factors and processes[3]; and within ID models, various types like the Marshallian ID (see Becattini 1990) and the Italian models (e.g. Dei Ottati 1994).

In this chapter we will consider IDs, in particular the Mark 2 and 3 types proposed by Bellandi and De Propris (2015). The industrial component of the ID will be referred as the local cluster including the main industries in which the cluster is specialised with complementary and subsidiary industries. An ID may host secondary industries with independent external factor and good markets.

A seminal work by Grabher (1993) investigates the Ruhr area as a famous case of a regional ID that fell in deep lock-in conditions, because of 'the very socioeconomic conditions that once made these regions stand out against the rest' (p. 256). After that paper, a large stream of literature, in evolutionary economic geography, has highlighted the tension between positive and negative effects of the agglomeration

[2]Sometimes, in literature, the term Local "Production" System is used to refer to the local business cluster featuring the industrial component of an ID.

[3]For example, in terms of path of development, shape and phase along a life cycle, types and plurality of sectors of specialisations, types of industrial organisation (heterarchical, hierarchical), types of local relations between the business organisation and the social and institutional context and types of relations with external agents and systems (see Cooke 2009; Hervas-Oliver et al. 2014).

of specialised industry, in particular regarding the adaptation and adaptability capacities of the system (see Ter Wal and Boschma 2011; Hassink 2017). Other authors stress the diversity and the complexity of the economic structure (e.g. Hausmann and Hidalgo 2011), or the so-called related variety (Frenken et al. 2007), as crucial resources for regional economic development.

The case study of the Baden-Wurttemberg district by Staber (2001) confirms the important role played by the mono-specialisation of the production system, together with the support given by a specific institutional context, in promoting the generation of a compact set of shared knowledge, values, languages and norms. The same can be strong sources of inertia when exogenous shocks occur, even if this is not a necessary effect. According to Belussi and Sedita (2012), heterogeneous evolutionary patterns follow from similar initial conditions and/or resource endowments and comparable opportunities. The systemic capability to adjust its economic structure is not only related to the number and size of local companies, as well as to the relations between them within the core industry, and to the heterogeneity and variability of the knowledge embedded in the local cluster (Menzel and Fornahl 2010). Access to different sources of knowledge plays a key role in promoting positive dynamics able to support innovation and competitiveness. IDs in Montebelluna (Italy) and Mirandola (Italy) are examples of diversification process strategies, whereas the IDs of Matera and Arzignano (also in Italy) exemplify differentiation and product upgrading strategies. These case studies show that there might be a variety of factors triggering an evolutionary change with positive dynamics (Belussi and Sedita 2012). The local cluster at the core of an ID can renew itself, when it exploits the heterogeneity of the local production knowledge. As stressed by Menzel and Fornahl (2010), an increasing heterogeneity may result from knowledge linkages with external organisations either locating into the system (e.g. the leather district in Arzignano and the microelectronics LPS in Catania) or acquired by the ID firms (as, e.g. the packaging LPS in Bologna and the eyewear district in Belluno).

The renewal of IDs' sets of knowledge rests on what external inputs they favour or support. A critical role is played here by the cultural background of the system. This includes not only traditions of productive, trade and welfare practices within the place but also the inherited institutional framework, together with business and social jargons, symbols, rituals, norms and values.

For example, the institutional framework can be the basis for initiatives that upgrade the local skills, strengthen the authenticity of local products with cultural-based activities (e.g. the Boot Museum in Montebelluna or the museums in the Jura Watch Valley), allow the absorption of knowledge flows and support the building and working of multilevel platforms for networks of innovators (MacNeill and Jeannerat 2016). On the other hand, barriers in exploiting new knowledge tend to increase along a path of development, because of the growing weight of the relational capital sunk in the same cultural background.

The next sections focus on variation and heterogeneity of production knowledge in IDs, comparing, in particular, Mark 2 and Mark 3 types (Bellandi and De Propris

2015), and considering the possibility of rerouting a mature ID Mark 2 to a renewed Mark 3 path, in face of contemporary technological and organisational challenges. Mark 2 IDs are characterised by a local innovation system largely dominated by endogenous processes of creation and diffusion of practical knowledge in the local cluster of specialised SMEs. Instead, in Mark 3 IDs, the internal structure and the production organisation are a 'global reference point for the exchange of ideas on specific professional and socio-cultural issues' (ibid. p. 75), and positive dynamics relates to the variation and heterogeneity of the productive knowledge located into the area. A Mark 2 type may have developed some latent Mark 3 features along its development path, and such features can emerge in the face of challenges if supported by specific strategies.

Before exploring such dynamics of endogenous rerouting, the next section introduces an explicit framework on the ID's learning processes and the accumulation of productive knowledge and competences.

3 IDs' Learning Processes and the Generation of New Know-How Nuclei

The issue of knowledge generation includes the sourcing and sharing of new knowledge (see Granovetter 1973; Burt 2004), the relations with different modes of innovation and the way in which various socio-economic ecosystems are able to absorb and promote innovation over time (Malerba 1992).

The ID mode of innovation is consistent with the doing, using and interacting (DUI) mode (Jensen et al. 2007), which is an experienced-based mode of collective learning. Concepts of 'decentralised industrial creativity' (Bellandi 1996), 'semi-automatic cooperation' (Dei Ottati 2009) and 'collective action and leadership' (Bailey et al. 2010) were proposed for the analysis of ID processes of innovation, which may be applied also for understanding processes of endogenous rerouting.

3.1 Accumulation of Knowledge in Processes of Long-Term Exploration and Exploitation

The ID may be seen as a complex socio-economic adaptive system (Lombardi 2003) characterised by paths of accumulation of 'localised technological knowledge' (Antonelli 1999). If irreversibility and inertia prevail along such paths, 'rigid specialisation trap' phenomena emerge (Grabher 1993), with a progressively decreasing knowledge variety.

Studies on learning processes in various types of socio-economic ecosystems have investigated the relation between the exploration of new knowledge bases and the exploitation of a set of acquired knowledge (March 1991).[4] For example, the early development phase of an ID, as well as its de-maturing phase, may be characterised by a high degree of exploration, which includes search, experimentation and discovery. Differently, maturity would be characterised by a more extensive exploitation, with phenomena such as refinement, efficiency and implementation. Systems that focus on exploration suffer high costs of experimentation, while those focussed on exploitation may be trapped in suboptimal stable equilibria. Therefore, an ID, in order to enjoy longevity, should be able to balance exploration and exploitation in a reproductive way.

The accumulation (or loss) and the balances (or unbalances) are regulated by the structural features of the ID, in terms of its institutional and cognitive frames. The latter, focus of this section, may be illustrated starting from the concept of 'useful knowledge' (Kuznets 1965), which concerns the manipulation of nature for human material gain throughout inventions and design of new techniques (Mokyr 2002). As highlighted by Mokyr, this notion includes two types of knowledge: 'propositional knowledge' that concerns natural phenomena and regularities and 'instructional or prescriptive knowledge' that includes instructions and techniques that can be executed. Propositional knowledge refers to what 'we today would call "science" (formalised knowledge)' (Mokyr 2002, p. 5); in particular, it relates to basic scientific researches, while prescriptive knowledge 'consists of a monstrous book of blueprints, whether codified or tacit, of techniques that society could carry out if it wanted' (ibidem, p. 5). Every specific socio-economic ecosystem, such as an ID, may apply just a small subset of the whole knowledge potentially available in a period, in relation to the productive specialisation and to the institutional features of the system. This is also related to the fact that part of the prescriptive knowledge is specific to the context of constitution, i.e. it combines tacit components within sets of knowledges not easily transferable outside the context (Fig. 1).

The agents rooted in an ID, with their competences, carry out in a distributed way a subset of specific prescriptive knowledge and the intersecting parts of easily transferable (codified, formalised) propositional knowledge. The selection of knowledge available within an ID, combined with the available competences, identifies the 'manifest entities of knowledge' (B*), i.e. the repository of productive (and social) practices adopted or that may be adopted by the agents of the ID (see Fig. 1). These components of the cognitive frame evolve through agents (within firms, families, public and collective agencies) who learn and upgrade localised knowledge, thanks to direct activities (e.g. specific investments in exploration of new manifest entities) and continuous feedbacks (e.g. effect of exploitation processes) (see lines Fig. 1).

The agents of innovation and change within the ID more or less intensively explore and seek interesting items of knowledge that circulate outside the selected set, and that could be incorporated in some ways within it. While all the ID agents work for the exploitation of knowledge, some act as 'gatekeepers' in processing

[4]Here the concepts of 'absorptive capacity' (Cohen and Levinthal 1990) and 'cognitive distance' (Nooteboom 2000) could be fruitfully considered and applied.

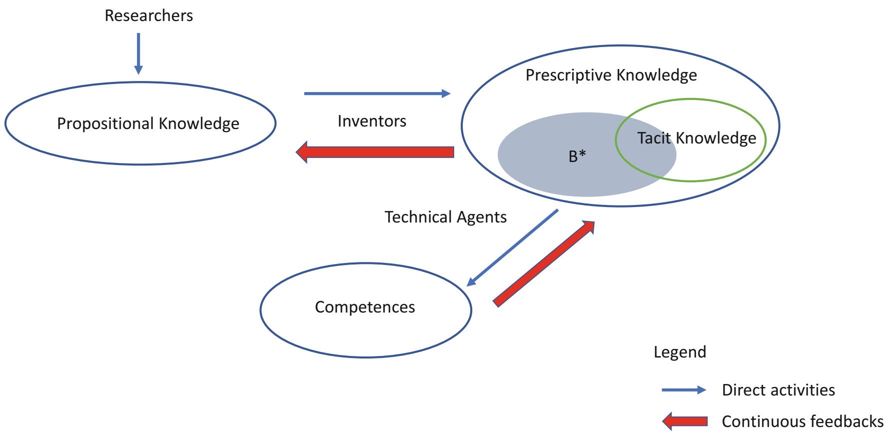

Fig. 1 The Mokyr's model of useful knowledge and competences. Source: Authors' elaboration

selected knowledge for reproducing and developing specific knowledge and practices. Following Mokyr's framework, the ID cognitive frame is identified by a mix of propositional knowledge, prescriptive knowledge and competences accumulated through time. Under a dynamical perspective, knowledge and competences grow, hybridise, disseminate continuously and variously and sometimes disappear.

The selected set of useful knowledge is not just distributed among the single ID agents, but it has an intermediate structure, made of subgroups of agents who have relatively homogeneous characters related to the cognitive frame, which we call the 'know-how nuclei' (Fig. 2). The distribution can change from one period to the next one.

The exploitation of 'useful knowledge', within and among the know-how nuclei of an ID, leads to a bottom-up generation of new knowledge to be explored. It may be argued, however, that without exploration activities spanning the not selected knowledge, the processes of bottom-up generation of new knowledge have decreasing returns, as it is suggested by Antonelli (1999) in the model of 'localised technological knowledge'. The 'not selected prescriptive knowledge' represents opportunities to be explored but yet to become manifest (dotted area in Fig. 2).

The institutions, as a set of rules and conventions, acting upon or within the ID, and the related political and collective bodies give differential incentives and coordination support to exploration and exploitation processes but may also imply barriers related to rent-seeking and inertia (Bailey et al. 2010). The institutional context has to adjust consistently both to the generation of new know-how nuclei and the incorporation of resources that are able to promote renewed paths of development. Barriers and contradictions in such process generate lock-ins (Santini 2016).

The cognitive core is therefore constantly exposed to new knowledge. Some knowledge can be found in the area, albeit not yet manifest. Other sets of knowledge, floating outside the area, can be accessed by gatekeepers, drawn inside the IDs, and

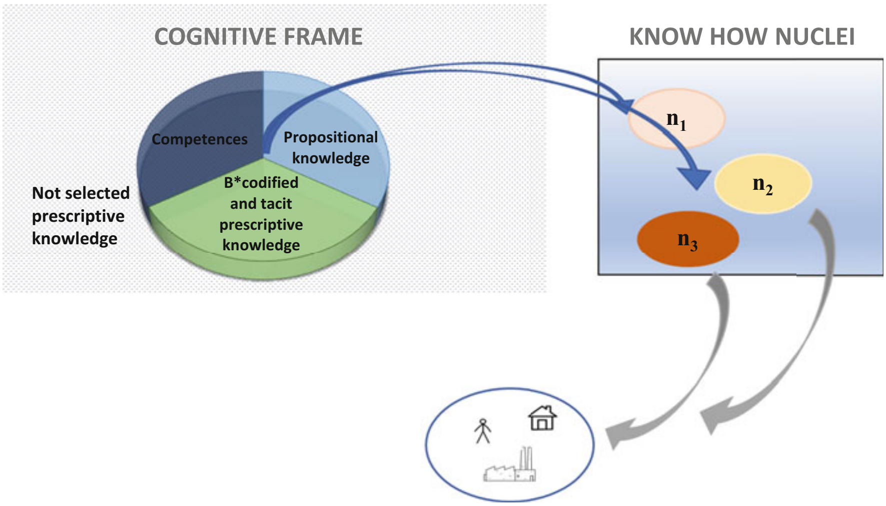

Fig. 2 Adaptation of the Mokyr's model to the ID cognitive frame. Source: Authors' elaboration

incorporated into the existing know-how to generate new know-how. In various periods and even recently, some IDs have performed exceptionally well in difficult competitive environments, pivoting around DUI-type of innovation processes. However, the current technological paradigm will soon be superseded by a new wave of technologies that will completely change the organisation of production inside and between firms. Such technological change will be perceived by IDs as an exogenous shock that will challenge most of the know-how and the innovation dynamics most ID firms might have been used to. We are suggesting, nevertheless, that IDs have endogenous capabilities to switch development path and avoid lock-in and decline.

3.2 *Pervasiveness of Digital Technology and New Opportunities*

Innovation always matters, and the process of creating new knowledge that can be translated in innovations has driven the competitiveness of firms, industries and places. However, it has been argued that technological change occurs in waves that start with the introduction of radically new technologies and unfold with the latter branching out applications, together with the emergence and stabilisation of a new techno-economic paradigm (Kondratieff 1979; Perez 2010). The idea is that there is a suite of new technologies, which will have a pervasive impact on the economy by generating countless of minor and incremental innovations able penetrate every aspect of the economy, both on the production and consumption sides, and the society in general.

There is some consensus on the identification of three more important waves, called 'industrial' revolutions (Perez 2010; Corradini and De Propris 2016). A cluster of new technologies and sectors is currently driving what could be seen as a fourth revolution. Think of the internet, information and telecommunications technology, nanotechnology, bioscience, electronics, micro- and nano-components for microsystems, green and renewables, 3D, artificial intelligence, robotics, sensoring and space technology and autonomous vehicle technology. The embryos of some of these new technologies can be traced back to the mid-1980s, but to witness their impact on production and sectors, we have to wait really until the turn of the century. This current wave is creating a completely new production model inside the factory and between firms. It is already referred to as 'Industry 4.0' or 'Manufacturing 4.0' or again 'Smart manufacturing'.

Four main changes capture the emerging manufacturing model. Firstly, digital technologies are increasingly adopted throughout the production process and between producers and customers. Secondly, new pathways to value creation are activated, for instance, with 'servitisation'. Thirdly, some of the new technologies lend themselves to efficiently scale down production processes and open up new opportunities for small producers that can tap into market niches for personalised, customised and innovative products. And, finally, almost all new technologies can be deployed to enhance the environmental sustainability of production processes and consumption via energy saving, bio-based products and fuel, remanufacturing and reusing of components.

For our argument, there is one important point worth making. Each wave of technological change is the outcome of scientific exploration, inside and across disciplines, leading to breakthroughs in the propositional knowledge we have of our world and in extended parts of prescriptive knowledge. Its effects ripple across the economy through a myriad of channels and over time. Technological change alters the organisation of sectors and places, institutional frameworks, consumption models, as well as the distribution of wealth, income and jobs across regions and classes. The awareness, access to and adoption of such new technologies on behalf of firms and systems vary depending on their absorptive capabilities and creative processes. Inevitably, technological changes will tend to be perceived as exogenous shocks by firms, IDs, production and socio-economic systems. The last wave introduces a complete new array of knowledge, whose usefulness and applicability are still to be fully revealed.

In particular, in IDs the ability to capture, decode, translate, integrate and leverage this new knowledge determines how it is combined, and recombined, with the existing sets of useful knowledge and competencies, to create what we have called 'new know-how nuclei'. In other words, those IDs which have endogenous mechanisms of adaptation and adaptability, allowing them to hybridise their embedded know-how, will be able to reroute their development path towards new ascending trajectories.

4 Endogenous Rerouting as Robust Transition Capacities

As stressed in the previous sections, the introduction of disruptive technologies in the global models of production is likely to impact on the traditional industrial organisation and its knowledge configurations. The balance between external economies among firms, specialisation economies within small firms and internal economies within larger firms should be adjusted to allow the IDs benefiting from the new wave of technological changes. The great opportunities offered to new artisans and makers (Porter and Heppelmann 2014), together with the organisational difficulties of giving standardised global solutions to the application of mass customization processes, tell that managing such balance in ways consistent with the ID nature is not only crucial but also possible. However, the mechanisms and resources of knowledge accumulation and innovation in IDs may be unable to explore, and embed, the technological opportunities exposed in Sect. 3.2 into new production, trade and organisational solutions. IDs follow different paths depending both on their embedded cognitive frame shaped by the knowledge accumulation dynamics and on the institutional frame that determines the opportunities for integrating and recombining new and existing sets of knowledge. In Mark 2 IDs, the not-yet selected prescriptive knowledge can be explored, potentially exploited and enlarged (enlargement of B*), especially by means of processes of doing, using and interacting by the agents of the different know-how nuclei, assuring in some cases the longevity of the system. It is a bottom-up accumulation of knowledge shaped by the idiosyncratic characteristics of the cultural heritage of each ID (Sect. 2). When a traditional set of know-how nuclei, embedded in the ID main industry, is at the core of such processes, the innovation capacity of the ID increases, bringing about gradual adjustment, and incremental innovation, but at a decreasing rate (see Antonelli 1999; Bellandi and Santini 2017). Under the hypothesis of a constant accumulation of 'localised technological knowledge' inside an ID over time, Fig. 3 describes an ID development path related to the change of local innovation capabilities (Santini 2016).

These self-reinforcing mechanisms of innovation and change may generate systemic incapacity to reshape the economic structure and face non-gradual changes,

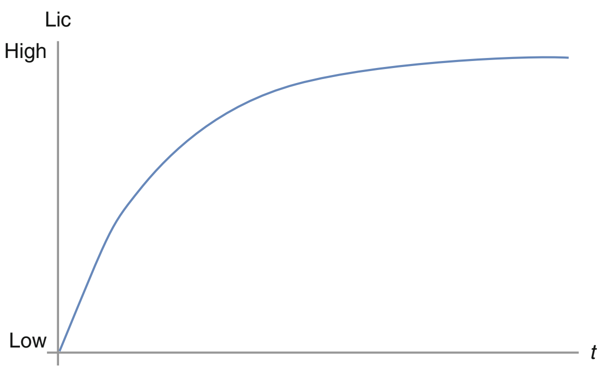

Fig. 3 Local innovation capacity (Lic) accumulating over time at a decreasing rate within a given ID structural configuration. Source: Authors' elaboration

such as those implied by the exploration and exploitation of useful knowledge related to the last wave of technologies. As the competences and knowledge cumulate into an ID within and around a well-defined specialised field, also the risks of irreversibility and inertia increase, since the set of knowledge embedded into the system becomes progressively obsolete, unable to hybridise, or to renew, its know-how configuration. The exhaustion of innovation thrust due to lock-in clashes with the constantly increasing innovation capacity of external competitors. Therefore, remembering the 'rigid specialisation trap' concept (Grabher 1993), the negative effects of an ever-deeper local specialisation on learning, and innovative activities, seem to be unavoidable and put at risk the ID longevity (see Staber 2001; Visser and Boschma 2004; Boschma 2005; Frenken et al. 2015).

Nonetheless, included in the knowledge generation processes drawn in Sect. 3.1, endogenous mechanisms of reaction may activate, under some conditions. Indeed, *decentralised industrial creativity* based on a DUI mode may seed new know-how nuclei more or less related to the traditional ones (Bellandi 1996), combining new external knowledge through gatekeeper activities (Hervas-Oliver and Albors-Garrigos 2014) and anchoring trans-local actors.[5] This embeddedness of external knowledge is particularly important for a proactive and rapid response to current technological challenges and to the massive mobility of knowledge, capital, individuals and goods, in general. However, it is somewhat underdeveloped in the Mark 2 models that have characterised the IDs re-emerging and championing the second half of the twentieth century (Bellandi and De Propris 2015). Furthermore, even when decentralised industrial creativity was able to promote multiplicity, and to inject the local knowledge pool with snippets of the new wave of technological change, a structural reconfiguration of the ID is not assured by Mark 2 models.

The embedding of new knowledge and competencies is regulated by the institutional context that supports knowledge exploration and exploitation in IDs, but this may also present barriers, and inertia, related to rent-seeking and coordination problems (Bailey et al. 2010). The latter factors are quite effective in IDs Mark 2 when these are challenged by the new technological waves, because of their very structural configuration, cognitively and institutionally focused on local networks of strong ties, presiding exploration and exploitation of new useful knowledge. This is the root cause of lock-in, and reduced growth, that hit even before the great international crisis, unleashing dramatic phases of crisis and decline (Bellandi and Santini 2017).

Some IDs have nonetheless been able to react and adjust, or even grow (Belussi and De Propris 2013). They have acquired ID Mark 3 features, such as an evolving sectoral variety and the inclusion in global networks of production, developing international knowledge flows coordinated by locally anchored actors (Bellandi and De Propris 2015). These same dynamics are bringing risks of fragmentation in ID processes, and loss of local identity, given the centrifugal tendencies related to the

[5]See, for example, Bellandi and Caloffi (2008); Crevoisier and Jeannerat (2009); Hervas-Oliver and Boix-Domenech (2013).

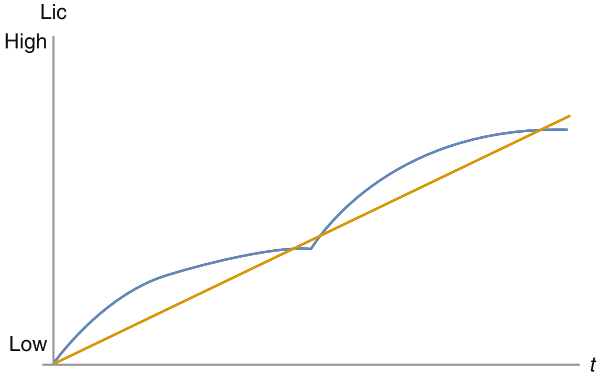

Fig. 4 Endogenous Rerouting promoting a boost in Local innovation capacity (Lic) against a constantly increasing capacity of external competitors along the time (*t*)

openness to extra-local networks and the disruptive tendencies related to an increasing rate of absorption of external knowledge and innovation. However, the defining ID nature may be preserved even with Mark 3 features, when the place has a cultural background supporting a large variety of interconnected firms that represent *life projects*, innervating the specialised fields of business and giving 'chorality' to the local social life (Becattini 2015). The rerouting of ID Mark 2 towards Mark 3 types in face of the new wave of technological challenges needs the presence and activation of latent mechanisms and resources of robust transition (Martin and Sunley 2015), embedded into the cognitive and institutional paradigms of an ID (Bellandi and Santini 2017). These can be:

(a) Local secondary industries hosting know-how nuclei related to new technologies that, partly replacing the traditional core, fertilise change by opening new fields of production and markets
(b) Producers within the traditional cognitive core who, being 'redundant', enter skill updating programs and support the development of new fields together with digital native workers and entrepreneurs
(c) Local leadership and participatory processes that, triggering plasticity in the institutional frame, help the transformation of the cognitive core and preservation of local identity and authenticity
(d) Local business and policy actors who, being involved in multi-territorial networks, promote the anchoring of international enterprises and the engagement of institutions related to digital, higher education, research and cultural fields

Both the multiplicity of non-obsolete know-how nuclei and the activation of latent mechanisms and resources are consistent with the local inherited identity and play a propelling role for IDs' longevity. Renewed paths of development branch out, driven by the growth of local innovation capacity (as illustrated in Fig. 4).[6] In this sense, the evolution described in Mark 3 IDs is neither so surprising nor accidental.

[6]See the case of the Swiss Watch Valley (Kebir and Crevoisier 2008), the reshoring phenomena in the UK automotive sector (Bailey and De Propris 2014) and many cases of Italian IDs (Belussi and De Propris 2013).

5 Conclusions

This paper has discussed how endogenous dynamics of IDs and LPSs may embed sets of knowledge, and mechanisms of rerouting, able to promote longevity of the same systems, even if the risks of lock-in, fragmentation and inertia cannot be underrated, as discussed in Sect. 2.

Section 3 explores the nature of learning processes and knowledge accumulation within IDs, referring in general terms to the new wave of technological change with digital manufacturing, servitisation, new makers and circular economy processes. As discussed in Sect. 4, some adapted forms of ID configurations (Mark 3) may be able to explore, absorb and exploit creatively the knowledge related to a new wave. Here, the endogenous rerouting is supported by the cultural background of the place that virtuously combines regional, national and global networks, together with a multiplicity of competences and know-how nuclei spawned into the ID area. However, the embedding of new knowledge and competencies may be blocked by the local institutional context, because of the dominance of strong ties limiting exploration and exploitation of useful knowledge. This would stifle the lively exchange of experiences within the local variety of interconnected firms that represent *projects of life*. The system, failing to access and exploit new external knowledge, loses innovative capacity and enters systemic fragmentation and decline of its unique identity.

Without the interpretative frame presented in this paper, misleading interpretations of ID development paths—in terms of lock-in and decline or rerouting and longevity—could be easily expressed. To explore the processes of endogenous rerouting, empirical research needs to align 'place-based' and 'cross-sectoral' perspectives. In future researches it will be crucial to understand and verify empirically the key elements of endogenous rerouting, in particular in face of the new wave of technological change.

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Natural Disasters and Firm Resilience in Italian Industrial Districts

Giulio Cainelli, Andrea Fracasso, and Giuseppe Vittucci Marzetti

Abstract We carry out a firm-level empirical analysis to evaluate the economic impact of the sequence of earthquakes that occurred in 2012 in the Italian region of Emilia-Romagna and to address the question of whether the localization of a firm within an industrial district mitigated or exacerbated this impact. We estimate the effect of the earthquake on firms' performance via two alternative methods: Difference-in-differences and propensity score matching in levels and first-differences. Our findings suggest that the earthquake reduced turnover, production, value added, and return on sales of the surviving firms, at least in the short term. In addition, the debt over sales ratio grew significantly more in the firms located in the areas affected by the earthquake. The empirical evidence also suggests that the negative impact of the earthquake was slightly higher for the firms located in industrial districts, thereby suggesting that, at least in the short term, the usually positive cumulative processes associated with localization within an agglomerated area could have reversed and magnified the negative impact of a disruptive exogenous supply shock.

Keywords Agglomeration economies · Natural disaster · Resilience · Industrial districts

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1 Introduction

The impact of natural disasters on economic growth has recently become the object of intense research. As the occurrence of natural events is most often unpredictable, these phenomena can be treated as exogenous shocks and serve as natural experiments to test various hypotheses.

Because of limited data availability, most analyses have been cross-country and based on macroeconomic data.[1] For those interested in either detecting specific channels of transmission of large supply shocks or assessing how local conditions affect the transmission of shocks, this approach is highly unpalatable.[2] As pointed out by Barone and Mocetti (2014), the investigation of a large firm-level dataset offers several advantages over the cross-country analysis and, in particular, it allows detecting how local conditions interact with the shocks, either amplifying or mitigating their effects.

In this paper, we develop a firm-level analysis to identify one specific channel of transmission of a localized natural disaster. In a nutshell, we try to assess whether the location of a firm within an industrial district mitigates or exacerbates the impact of a disaster on the firm's activity and performance. While a consensus has been reached on the fact that industrial districts generate positive externalities that improve firms' performance (see, among others, Cainelli 2008a, b) it remains unclear whether the localization of a firm in an industrial district also strengthens its resilience in the face of large and disruptive exogenous supply shocks. This is not a singular question. As observed by Merz et al. (2013), the impact of a disaster depends on hazard and exposure but also on the vulnerability of the local productive system to business interruptions. The indirect effects of a natural disaster (as the business interruptions analyzed by Kousky 2014) may be as important as the direct impact.

Our empirical analysis will be conducted on a sample of firms operating in Emilia-Romagna (a region in the Northeast of Italy) in the period 2010–2013. This industrialized region was hit by an earthquake sequence of severe intensity between

[1]See, among others, Skidmore and Toya (2002), Raddatz (2007), Hallegatte and Dumas (2009), Noy (2009), Strobl (2011), Loayza et al. (2012), Ahlerup (2013), Cavallo et al. (2013), Fomby et al. (2013), Belasen and Dai (2014), Cunado and Ferreira (2014), as well as the review of the literature by Cavallo and Noy (2009) and the very recent meta-analysis of the macroeconomic literature by Lazzaroni and van Bergeijk (2014).

[2]Barone and Mocetti (2014) cross-country analyses present other drawbacks. First, natural disasters tend to be geographically concentrated so that investigations covering extremely large areas may fail capturing very localized effects. Moreover, analyses on aggregated data for the national economy can hardly capture specific channels of shock transmission within and across the nation. As certain countries register a systematically higher number of climatic and geological events (flooding, earthquake, and hurricanes), country-level studies may also suffer for the endogeneity of proactive defensive measures by the authorities and the population. Regional and subregional studies are less likely to suffer from this bias, as the exact localization of certain phenomena (say, the epicenter of an earthquake) is difficult to predict and it is unlikely to find highly localized preventive measures. Other empirical problems with cross-country studies may emerge when different natural disasters are pooled together.

20 May and 6 June, 2012. Besides some casualties, damages were widespread: historical and private buildings collapsed or suffered large damages; warehouses and factories were partially or totally destroyed.

This recent event has not yet been covered in the literature, and this work contributes by exploring its effects on the performance of the local economy. More importantly, this paper is the first, to the best of our knowledge, addressing whether the localization of a firm inside an industrial district worsens or mitigates the effects of an exogenous and disruptive supply shock. Since industrial districts are a fundamental feature of the Italian manufacturing system, our research question is of particular interest for the resilience of many other local systems in the country.

The remainder of the paper is organized as follows. In Sect. 2, we review the literature on the economic impact of natural disasters and firms' resilience in industrial districts. Section 3 presents the dataset and the econometric methodology. Section 4 discusses the main results. Section 5 concludes.

2 Related Literature

2.1 Firms and Natural Disasters

The contributions uncovering the impact of natural disasters on the basis of firm-level analyses are very recent. Only few studies have investigated the performance of firms after the realization of a localized major supply shock.[3]

As each contribution focuses on different aspects and implications of disasters (ranging from firm survival to firm performance, from supply network disruptions to localization choices), few studies address comparable research questions on different natural disasters. This prevents from generalizing specific empirical findings to all types of natural disasters and to all countries hit by the same type of shock. Accordingly, we group these studies in terms of country of interest rather than in terms of empirical research question. Possibly because of the importance of natural disasters in a country frequently hit by earthquakes and tsunamis and thanks to the availability of high quality microdata, the majority of the works in this area of research regards Japan. Hence, we start discussing the studies exploring the impact of natural disasters which occurred in Japan, and subsequently we move to catastrophic events realized in other areas of the world.

Cole et al. (2013) use very detailed data on the plant-level damages produced by the 1995 Kobe earthquake in Japan to estimate the impact of damages on firms' survival and analyze the performance of damaged and non-damaged plants surviving the earthquake. They find that, while highly damaged firms face prolonged difficulties and higher risk of exiting, the value added and employment performance of the

[3]Leiter et al. (2009) study the impact of floods on European firms, but given the use of regional aggregated data, their investigation does not fall in the group of firm-level analyses.

surviving firms are lower only during the reconstruction period and higher afterward (while productivity is surprisingly higher in all periods).

Rather than focusing on firm survival and/or performance, some studies have addressed the impact of a natural disaster on the relationship between the firms hit by the shock and others related with them along the supply chain. The role of supply chain networks in the recovery of firms hit by a disaster is investigated by Todo et al. (2013), who focus on the 2011 Great East Japan earthquake. They find that supply chains have two contrasting effects on the firms hit by the shock: on the one hand, supply chains negatively affect the recovery through the firms' higher vulnerability to network disruptions, but on the other hand, they facilitate the recovery through the support received from trading partners, the easier search for new partners, and the general benefits of agglomeration. The authors find that, all in all, the positive effects of supply chains exceed the negative ones, at least to the extent that firms participate in a variety of supply chains.

Focusing on the firms located outside the damaged areas, Tokui et al. (2017) assess the transmission through supply chain disruptions of the negative effects of the Great East Japan earthquake. Tokui and co-authors construct an interregional IO table to assess the economic impact of supply chain disruptions in regions of Japan outside the damaged areas and find that the existence of multiple supply chains would have highly mitigated the indirect damage of the disaster, which was instead remarkable. This finding is in line with the conclusions by Carvalho et al. (2014), who look at the transactions (i.e., sales growth) between firms after the tsunami following the Great East Japan earthquake and show that firms outside the damaged areas encountered serious difficulties in substituting former suppliers and buyers located in the damaged area that exited the business, with cascading effects. The search for new suppliers appears more difficult than that for new customers. The results in Carvalho et al. (2014) as well as Tokui et al. (2017) suggest the existence of bottlenecks in production associated with an imperfect substitutability of intermediate inputs provided by different suppliers.

The Great Kantō earthquake in 1923 is investigated by Imaizumi et al. (2016), who assess whether it had a persistent impact on the spatial distribution of industries in the Tokyo Prefecture. The authors find significant shift in trends in the share and number of workers though not mean shifts. Moreover, they show that old industrial clusters in the southeast of Tokyo were highly affected, whereas newly developing industrial clusters outside the damaged areas faced new opportunities. These findings suggest that both the geographical localization and the position in the supply chain of firms contribute to determine the impact of a natural disaster on firm performance. These results are in contrast with those found in the work closest to our investigation (Cole et al. 2015): they show that, although clustering has a negative impact of plant survival probabilities after the 1995 Kobe earthquake in Japan, the location of a firm in a cluster does not impact much on its performance after the shock. This conclusion is in line with the evidence of this work.

As to what concerns the studies focusing on countries other than Japan, we recall Mel et al. (2012), who investigate the business recovery in Sri Lanka after the 2004 tsunami. They find that the firms affected by the disaster lagged behind for a longer period than the unaffected comparable ones and also show that direct aid played a role in the recovery, in particular in the service sector. Similar results on the role of state aid are found by Coelli and Manasse (2014), who look at the impact of the floods occurred in the Italian region of Veneto in 2010. Coelli and Manasse (2014) use a difference-in-differences (DID) approach to compare the value added growth of firms exposed and not exposed to the floods and find that (1) after a period of recovery, the affected firms perform better than those not affected by the floods and (2) the contribution of aid transfers in the aftermath of the disaster contributes significantly to the recovery of firms. Vu and Noy (2018) focus on the consequences of natural disasters on Vietnamese firms and find that a negative impact on retail sales is however accompanied, albeit only in large urban areas, by increases in firm investment. As in previous studies on Japanese disasters, this suggests that surviving firms invest to overcome temporary, though serious as they be, difficulties.

Focusing on the behavior of multinational enterprises (MNEs) in the face of natural disasters, Hayakawa et al. (2015) analyze the effects of the 2011 flooding in Thailand on the procurement patterns at Japanese affiliates. Only small and directly affected firms lowered their local procurement share, suggesting that natural disasters do not have persistent effects on firms' subjective risks of local procurement. Moreover the adjustment of nonlocal sources by MNEs depends on their knowledge about suppliers, i.e., their ex ante preparation of alternative procurement sources. The importance of ex ante conditions is also stressed by Fabling et al. (2014), who analyze the heterogeneous impact of the Canterbury earthquakes in September 2010 and February 2011 on firms across industries and locations. They find that the pre-shock profitability increases the chances of survival in this region of New Zealand. From an empirical point of view, these findings remind of the importance of taking seriously into account confounding factors that may characterize firms both before and after the treatment.

In conclusion, this literature underlines three aspects. First, the firms that are not too seriously damaged and do not have to exit do recover in a relatively short time; this often requires extra investment and some external forms of support. Second, firms located outside the area hit by the shock may be indirectly affected by the disaster through supply disruptions, but this is more relevant for the companies that do not have a diversified range of suppliers and customers. The importance of this indirect channel outside the area hit by the shock grows with the intensity and the dispersion of the damages. Third, both the geographical localization and the position in supply chains contribute to determine the impact of a natural disaster on firms' performance.

2.2 Industrial Districts and Firms' Resilience

While the role of industrial districts[4] have been extensively investigated from different perspectives in the economics and management literature, to best of our knowledge, there is no paper focused on the capacity of an industrial district of positively reacting to a short-term external shock such a localized natural disaster. The literature on industrial districts does not offer any clear prediction whether the location of a firm in one of these local productive systems strengthens or weakens its resilience[5] to large supply shocks. On the one hand, such location may provide the well-known positive advantages associated with agglomeration externalities (typically reflected into higher productivity and profitability, as well as higher rates of survival): in such a case, firms located within a district may cope better with the consequences of a disaster. Moreover, these firms may benefit of greater risk-sharing mechanisms, via interlinking transactions (Dei Ottati 1994), as shown by Cainelli et al. (2012). Finally, fiscal stimulus and external aid may flow faster toward industrial districts than elsewhere, at least insofar as firms in a district have a vantage position in terms of signaling, lobbying, and political connections (Brusco 1982; Brusco et al. 1996; Brioschi et al. 2002; Cainelli and Zoboli 2004).[6]

On the other hand, the self-enforcing mechanisms at work in an industrial district may set in motion negative domino effects in the aftermath of a localized disruptive shock. There are different channels through which the cumulative processes associated with localization in a district may reverse and magnify the impact of the shock. The first channel is the transmission of the shock through the supply chain network. Carvalho et al. (2014) find that the sale growth of firms outside an area hit by a large

[4]The concept of industrial district dates back to Marshall (1920). In the late 1970s, Becattini (1989) and Brusco (1982) "revisited" the original Marshallian concept in an effort to explain the socio-economic development in the Third Italy. Although there is no universally accepted notion of industrial district (Cainelli 2008a), a definition of the "canonical" Italian industrial district model acceptable to most scholars is a "territorial agglomeration of small firms normally specialized in one product or phase of production, held together by interpersonal relationships, by the common social culture of workers, entrepreneurs and politicians surrounded by an industrial atmosphere which facilitates the diffusion of innovation, generating in this way important flows of external economies that are still internal to the local productive systems" (Bianchi 1994, p. 14).

[5]The literature provides alternative definitions of resilience. The ecological approach defines regional resilience as the capacity of a region to move from a possible steady-state path to another (Reggiani et al. 2002). The engineering approach defines regional resilience as the capacity of a region of coming back to a persistent steady-state equilibrium after a shock (Rose 2004). Recently, the economic geography literature has put attention on a different concept of resilience, which refers—from an evolutionary perspective—to a region's capacity of positively reacting to a short-term external shock (Simmie and Martin 2010; Martin 2012). In this paper we follow this perspective.

[6]Focusing on aggregated data, Noy (2009) finds that countries with a higher literacy rate, better institutions, and higher degree of openness to trade withstand better the disasters, possibly because they succeed in rapidly mobilizing human and financial resources. Drawing a parallel with these findings, one could expect industrial districts to enjoy a vantage position in terms of local ability for mobilizing resources.

shock is negatively affected by the exiting of upstream and downstream firms in the affected geographical area.[7] Thus, given the high density of the (productive, technological, and commercial) relationships among firms in industrial districts, the shock transmission along the supply chain may be stronger within these local systems than in non-district areas.[8] As shown by Todo et al. (2013) and Tokui et al. (2017), firms may indeed benefit from enjoying a geographically diversified network of suppliers and clients, because this facilitates the substitution of damaged partners after a localized shock. Another potential channel through which firms in an industrial district may be more severely hit pertains to the financial realm: if banks have localized lending relationships, a disaster may negatively impact on the provision of external finance to the firms located in the affected area.[9] Finally, the location in an industrial district may magnify the impact of a disruptive supply shock because of the relative larger importance of damages to local infrastructures, at least to the extent that natural amenities contribute to agglomeration in industrial districts.

As theory does not tell whether the location in an industrial district makes a firm more or less resilient in the face of a disruptive exogenous supply shock, new empirical analyses are of great importance to improve our understanding of how natural disasters hit firms and whether their localization within a district makes a difference or not for their performance.

3 Data and Empirical Approach

3.1 Data

Between 20 May and 6 June 2012, the Emilia-Romagna region, located in the Northeast of Italy, was hit by a sequence of severe earthquakes. The first one (magnitude 5.9) struck close to Bologna, and its epicenter was in the area near the town Finale Emilia. This was followed by two aftershocks of lower magnitude (still above 5). A magnitude 5.8 earthquake hits the same area on 29 May 2012, followed by another sequence of earthquakes. Two aftershocks hit again: the first on 3 June and the second on 6 June.

[7]The impact on downstream firms is shown to be at work for the firms linked both directly and indirectly.

[8]Such hypothesis is consistent with the conclusions by Henriet et al. (2012), who, via a simulation analysis based on input-output tables, show that clusters hit by a shock suffer less when they are not too concentrated and that the resilience of the economic system to natural disasters is higher when supply chains are localized and each cluster is isolated from external disasters.

[9]As shown for Japan by Uchida et al. (2013), this may not be the case if damaged banks receive external financial support from either the government or other private investors. Hosono et al. (2016) show that the lending capacity of banks located in an area affected by a disaster is reduced and impacts firms' investment, even when firms are located outside such area.

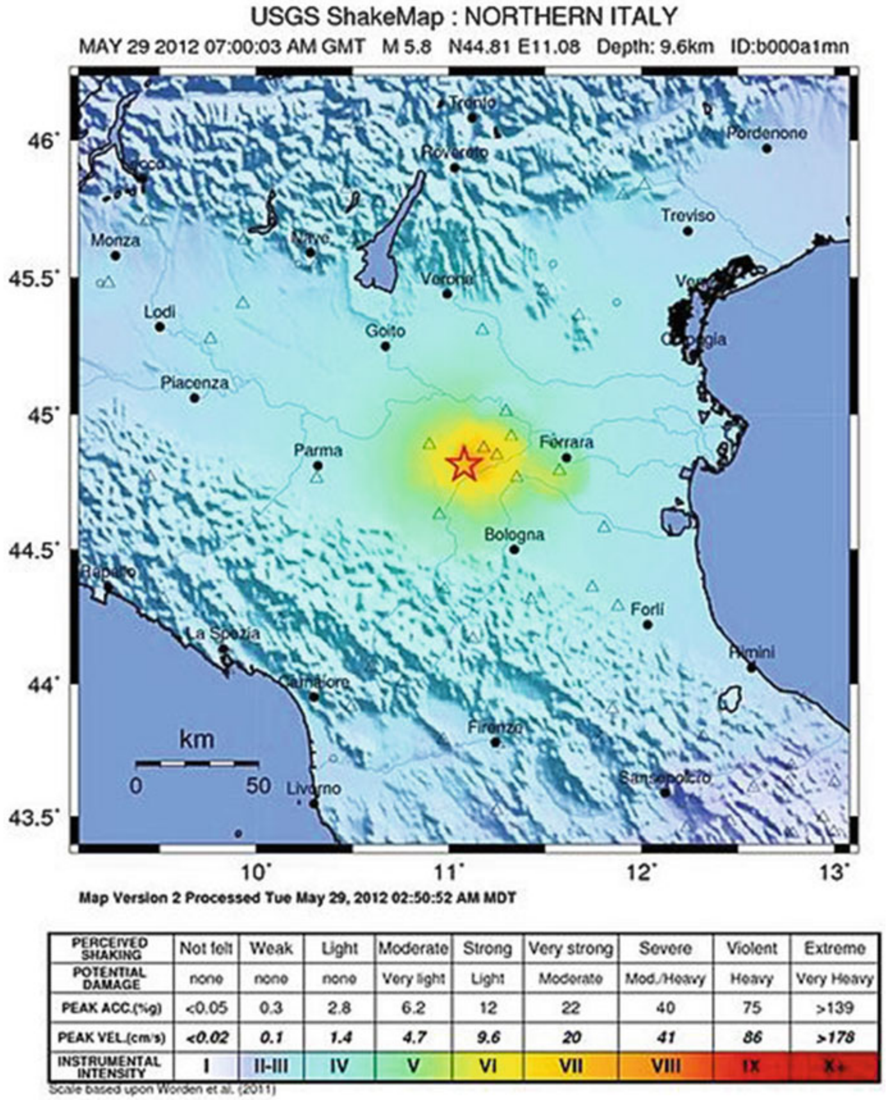

Fig. 1 A map of the Emilia-Romagna earthquake in 2012. Source: Wikimedia

This natural disaster caused serious damages to private and public buildings, as well as to productive units. Figure 1 offers a graphical representation of the impact of the earthquake on 29 May 2012 in the Emilia-Romagna region.

As shown in Fig. 1, the earthquake was powerful but highly localized as only light shaking was perceived outside the areas closest to the epicenter. Given the high manufacturing density in Emilia-Romagna and the presence of several industrial districts (Brusco et al. 1996), this event represents a natural experiment which can be

Table 1 Breakdown of the sample of firms by earthquake and district

Industrial district	Earthquake		Total
	No	Yes	
No	14,937	1886	16,823
Yes	6940	2522	9462
Total	21,877	4408	26,285

used to assess whether the location of firms in an industrial district enhances or weakens their economic resilience.

To tackle this issue, we use information drawn from the *Bureau van Dijk* database. Specifically, we construct a sample of about 26,000 firms (in manufacturing and KIBS) located in Emilia-Romagna during the period 2010–2013. As summarized in Tables 1 and 2, one third of these firms are located in an industrial district, and less than 10% are placed in areas hit by the earthquake. More importantly, the tables show that not all the firms hit by the earthquake are in an industrial district and not all the firms located within an industrial district are placed in areas hit by the disaster. This allows us to adopt different econometric methods to identify the differentiated impact of the earthquake across firms and districts.

In this work we focus on a number of proxies for firm's performance: turnover; tangible assets; bank debt/sales ratio; value of production; return on sales (ROS), i.e., EBIT/net sales; and return on equity (ROE), i.e., net income/equity.

As we aim at detecting the earthquake impact on firms' performance and to differentiate the analysis according to whether firms are located in industrial districts or not, for each firm we need more than one observation: one before the earthquake and one afterward. Since the earthquake hit Emilia-Romagna in mid-2012, it is not theoretically clear whether the pre-shock performances (calculated as the average values in the years 2010–2011) are to be compared either with the 2012 end-of-year values or with those in 2013. According to previous contributions, we expect to find stronger results for the 2012 because the firms that survive a disaster tend to absorb the shock rather quickly. By running the estimations for both 2012 and 2013, we shall test this intuition and indirectly assess both the short and longer effects of the disaster on the surviving firms.

3.2 Methodology

The aim of this section is to illustrate our empirical methodology. We address two research questions: (1) the impact of the earthquake sequence on the firms' performance after the shock and (2) the differential impact of the earthquake according to the localization of the firms inside or outside an industrial district.

Table 2 Breakdown of the sample of firms by sector, earthquake, and district

	No earthquake—no district			Earthquake—no district			No earthquake—district			Earthquake—district			Total	
ATECO 2-digit	No.	Col %	Row %	No.	Col %	Row %	No.	Col %	Row %	No.	Col %	Row %	No.	Col %
10	542	3.6	50.7	52	2.8	4.9	411	5.9	38.4	65	2.6	6.1	1070	4.1
11	36	0.2	42.4	4	0.2	4.7	34	0.5	40.0	11	0.4	12.9	85	0.3
13	39	0.3	18.8	14	0.7	6.7	45	0.6	21.6	110	4.4	52.9	208	0.8
14	173	1.2	28.3	72	3.8	11.8	111	1.6	18.2	255	10.1	41.7	611	2.3
15	99	0.7	63.5	9	0.5	5.8	40	0.6	25.6	8	0.3	5.1	156	0.6
16	147	1.0	55.7	23	1.2	8.7	62	0.9	23.5	32	1.3	12.1	264	1.0
17	80	0.5	48.5	13	0.7	7.9	46	0.7	27.9	26	1.0	15.8	165	0.6
18	234	1.6	59.8	22	1.2	5.6	85	1.2	21.7	50	2.0	12.8	391	1.5
19	2	0.0	25.0	0	0.0	0.0	4	0.1	50.0	2	0.1	25.0	8	0.0
20	174	1.2	58.8	32	1.7	10.8	77	1.1	26.0	13	0.5	4.4	296	1.1
21	17	0.1	48.6	6	0.3	17.1	6	0.1	17.1	6	0.2	17.1	35	0.1
22	226	1.5	46.0	40	2.1	8.1	142	2.0	28.9	83	3.3	16.9	491	1.9
23	368	2.5	67.3	17	0.9	3.1	136	2.0	24.9	26	1.0	4.8	547	2.1
24	63	0.4	46.3	21	1.1	15.4	39	0.6	28.7	13	0.5	9.6	136	0.5
25	1392	9.3	50.3	259	13.7	9.4	752	10.8	27.2	366	14.5	13.2	2769	10.5
26	196	1.3	49.5	40	2.1	10.1	123	1.8	31.1	37	1.5	9.3	396	1.5
27	268	1.8	51.8	57	3.0	11.0	139	2.0	26.9	53	2.1	10.3	517	2.0
28	1184	7.9	52.7	195	10.3	8.7	614	8.8	27.3	254	10.1	11.3	2247	8.5
29	94	0.6	46.8	19	1.0	9.5	61	0.9	30.3	27	1.1	13.4	201	0.8
30	81	0.5	70.4	8	0.4	7.0	25	0.4	21.7	1	0.0	0.9	115	0.4
31	135	0.9	46.4	14	0.7	4.8	126	1.8	43.3	16	0.6	5.5	291	1.1
32	210	1.4	61.4	23	1.2	6.7	70	1.0	20.5	39	1.5	11.4	342	1.3
62	683	4.6	62.1	78	4.1	7.1	272	3.9	24.7	67	2.7	6.1	1100	4.2
63	549	3.7	63.2	50	2.7	5.8	215	3.1	24.8	54	2.1	6.2	868	3.3
68	5053	33.8	60.2	540	28.6	6.4	2124	30.6	25.3	671	26.6	8.0	8388	31.9

69	323	2.2	64.0	27	1.4	5.3	141	2.0	27.9	14	0.6	2.8	505	1.9
70	997	6.7	65.9	81	4.3	5.4	360	5.2	23.8	74	2.9	4.9	1512	5.8
71	580	3.9	60.2	69	3.7	7.2	263	3.8	27.3	51	2.0	5.3	963	3.7
72	105	0.7	62.1	16	0.8	9.5	42	0.6	24.9	6	0.2	3.6	169	0.6
73	340	2.3	62.7	36	1.9	6.6	145	2.1	26.8	21	0.8	3.9	542	2.1
74	546	3.7	60.9	49	2.6	5.5	230	3.3	25.7	71	2.8	7.9	896	3.4
Total	14,937	100.0	56.8	1886	100.0	7.2	6940	100.0	26.4	2522	100.0	9.6	26,285	100

3.2.1 The Average Impact of the Earthquake Sequence

To estimate the effect of the earthquake on firms' performance, we employ two alternative methods: (1) difference-in-differences (DID) and (2) propensity score matching (PSM) on the variables of interest in levels and first-differences (measured both before and after the earthquake).

These two methods require that some conditions are fulfilled. The most important is the presence of a reliable control group, that is, a subsample of firms not hit by the earthquake. The second condition is that the selection of the firms into treatment (i.e., being located in an area hit by the earthquake) is independent from the characteristics of firms that also affect their performance. In other words, these methods require the existence of the same unit of observation before and after the treatment. This implies that we focus only on surviving firms.

The DID approach compares the change in the performance of firms located in an area hit by the earthquake with the change in the performance of firms placed in a territory not affected by the disaster, after controlling for a number of firm-specific and area-specific characteristics.

Assuming that y_{it} is the performance variable of interest (e.g., production, value added, etc.) for the firm i in period t, the impact of the earthquake can be captured by estimating either:

$$y_{it} = a_i + \beta_0 t_t + \beta_1 e_t + \beta_2 e_i t_t + u_{it} \tag{1}$$

or

$$\Delta_{yi} = \delta_0 + \delta_1 e_i + \delta_2 X_i + \nu_i \tag{2}$$

where $t \in \{0,1\}$ is the pre- and post-earthquake period, t_t is the time dummy (equal to 1 if $t = 1$), e_i is the earthquake dummy (equal to 1 if the firm is located in an area hit by the earthquake in period 1 and 0 otherwise), and X_i contains firm-level exogenous controls (sector, year of incorporation, etc.). The main difference between Eqs. (1) and (2) is that the latter, by differentiating, removes any time-invariant unit-specific effects on the level but allows to consider firm-specific controls possibly affecting the rate of change. The former can take two forms: a pooled estimation or a fixed-effect panel estimation to absorb the impact of any firm-specific time-invariant controls.

The variable of interest in Eq. (1) is the term $e_i t_t$, which captures the average effect of the disaster on the level of the performance of interest, after controlling for X_i. The variable of interest in Eq. (2) is the dummy e_i that is used to assess the average effect of the treatment on the change of the performance variable of the treated firms.

When there are reasons to believe that the treatment might not be randomly distributed across the units and that there might be confounding factors affecting the DID estimator, an alternative approach to quantify the effects of the earthquake on the firms is the propensity score matching (PSM). PSM controls for confounding factors in the estimation of the impact of the treatment by ensuring that the comparison is performed using treated and control units that are as similar as possible. Three steps need to be done: (1) the pretreatment firm characteristics are summarized in a single variable (the propensity score) by means of a probit/logit estimation; (2) similar treated and control firms are matched; and (3) the average effect of the treatment on the treated is calculated as the average difference between the values of the variable of interest for the treated firms and the control firms in each pair of matched firms. The more and better are the variables used to calculate the propensity scores, the more efficient is the removal of confounding factors. In order to work, this approach requires that the sample contains enough pairs of treated and control units with the same propensity score.

The nature of the shock suggests not worrying about problems of self-selection into treatment: before the disaster, the region was considered as having very low systemic risk, and no firm chose its location on the basis of the probabilities of being hit by an earthquake. Nonetheless, given that the geographical distribution of firms operating in different industries is neither homogeneous nor random, one may want to control for the possibility that the average treatment effect may (statistically) reflect sector-related confounding factors.

3.2.2 The Differentiated Effect of Industrial Districts

These two methods capture the average effect of the treatment on the treated, that is, the average impact of the earthquake on the firms located in areas directly affected. This is the first issue that we deal with. The second research question regards the differentiated impact of the earthquake on firms that are located in industrial districts with respect to those that are not.

Generally, firms choose where to locate: their being inside or outside an industrial district is likely correlated with their characteristics. Accordingly, one cannot use the same approach also to address the differentiated effect of the earthquake across geographical areas that are and are not industrial districts. This forces us to work on the previous specification and insert a set of dummies and interacting terms to estimate the differential impact of a unique treatment, i.e., the earthquake.

$$y_{it} = c_i + \gamma_0 t_t + \gamma_1 d_i t_t + \gamma_2 e_i t_t + \gamma_3 e_i d_i t_t + \varepsilon_{it} \tag{3}$$

or

$$\Delta_{yi} = \pi_0 + \pi_1 d_i + \pi_2 e_i + \pi_3 e_i d_i + \pi_4 X_i + \nu_i \tag{4}$$

where d_i is a district dummy (equal to 1 if the firm belongs to an industrial district and 0 otherwise).

The variables of interest in Eq. (3) are the term $e_i d_i t_t$, capturing the district-related difference in the treatment effect on the outcome variable y, and the term $e_i t_t$, that assesses the average treatment effect on the treated firms for the performance of interest. In Eq. (4), the same holds, respectively, for the interaction dummy $e_i d_i$ and the dummy e_i.

4 Results

Table 3 reports the average impact of the earthquake on the performance of firms located in the affected areas, with no distinction between industrial districts and other areas.

For the year 2012, we obtain consistent estimates from the different estimators adopted: OLS pooled DID, panel fixed-effects DID, first-differences DID, and PSM. The earthquake, on average, reduces turnover, production, value added, and ROS. These estimates are all statistically significant for the OLS estimates in levels and for the OLS and PSM in first-differences; only ROS seems instead significantly affected by the disaster according to the PSM in levels. The panel fixed-effects and the first-differences estimations (OLS and PSM) suggest that the debt over sales ratio significantly grows more in the firms located in the areas affected by the earthquake. Intuitively, these results have an economic sense. Firms affected by the earthquake performed, on average, worse than the others, but they survived also thanks to expanding their debt. Notably, the debt variable is significant only when fixed-effects or first-differences are considered: this suggests that there is a differential variation in the accumulation of debt rather than a differential level-effect.

For the year 2013, only the variation in the debt over sales ratio remains statistically significant in fixed-effects or first-differences panels, as well as PSM. Besides this, there is also some weak evidence of a differentiated growth in the volume of tangibles, whereby hit firms accumulated more tangibles. In fact, had we looked exclusively at 2013, we would have concluded that the earthquake had no impact on the firms located in the areas affected by the disaster. In fact, as the analysis in 2012 shows, firms were affected but did also recover fast (this result is in line with the other studies reviewed before). The possibility of tapping credit seems particularly important for firms to bear such large a shock.

Having established the average effect of the earthquake on the performance of the surviving firms, we move to our second research question, that is, whether the location of a firm in an industrial district exacerbates or mitigates the impact of the earthquake. Our evidence (Tables 4, 5, 6 and 7) suggests that there is a negative impact of the earthquake on the activity and efficiency of firms. This effect is higher in the short term (2012) for the industrial district firms. This is true for production, turnover, value added, and ROS. Similarly, the increase in firms' indebtedness (debt/sales) is particularly significant for the firms located in these local productive systems.

This finding supports the hypothesis that industrial districts may exhibit lower resilience in the face of a large and disruptive supply shock because the cumulative processes associated with localization externalities may reverse and magnify the negative impact of adverse phenomena. The shock transmission may work through three different mechanisms: (1) the supply chains (Carvalho et al. 2014), (2) the weakening of agglomeration externalities, and (3) the existence of local risk-sharing mechanisms that increase the probability of mass defaults (Cainelli et al. 2012). Our results do not support the hypothesis that industrial district firms may be affected by a localized credit crunch as they do manage to increase their debt levels.

Table 3 Estimation results

	Level									
	Pooled estimation				Panel FE: 2010/2011		First difference: 2010/2011			
	2012		2013				2012		2013	
Dependent variable	OLS	PSM	OLS	PSM	2012	2013	OLS	PSM	OLS	PSM
Ln(turnover)	−0.0485*	−0.0033	−0.0128	0.0318	−0.0281**	−0.0003	−0.0225**	−0.0223*	0.0150	0.0138
	(0.0265)	(0.0362)	(0.0272)	(0.0367)	(0.0118)	(0.0150)	(0.0114)	(0.0123)	(0.0145)	(0.0158)
Ln(tangibles)	−0.0060	0.0036	0.0289	0.0382	0.0015	0.0299	0.0010	−0.0004	0.0301*	0.0295*
	(0.0356)	(0.0457)	(0.0365)	(0.0463)	(0.0117)	(0.0158)	(0.0117)	(0.0126)	(0.0164)	(0.01750)
Debt/sales	−0.5790	−0.3758	−0.0551	−0.0487	0.8761***	1.107***	0.7413***	0.7469***	1.012***	0.9642***
	(0.4395)	(0.4747)	(0.4508)	(0.4792)	(0.2646)	(0.3302)	(0.2807)	(0.2967)	(0.3403)	(0.3579)
Ln(value-added)	−0.0573**	−0.0377	−0.0410	−0.0210	−0.0471***	−0.0094	−0.0451***	−0.0442***	−0.0051	−0.0065
	(0.0285)	(0.03659)	(0.0292)	(0.0374)	(0.0129)	(0.0151)	(0.0134)	(0.0142)	(0.0151)	(0.0161)
Ln(production)	−0.0563**	−0.0117	−0.0152	0.0301	−0.0368***	0.0002	−0.0282***	−0.0289***	0.0136	0.0123
	(0.0259)	(0.0354)	(0.0266)	(0.0358)	(0.01108)	(0.0140)	(0.0108)	(0.0115)	(0.0137)	(0.0147)
ROE	0.3185	0.2943	0.9978**	1.0563**	−0.8054	0.1686	−0.4791	−0.3078	0.3343	0.4914
	(0.5300)	(0.5623)	(0.5004)	(0.5366)	(0.5366)	(0.5606)	(0.5739)	(0.5970)	(0.5753)	(0.6102)
ROS	−0.7590***	−0.8103***	−0.3024	−0.4231*	−0.6227***	0.0589	−0.5348***	−0.5658***	0.0930	0.0468
	(0.2389)	(0.2483)	(0.2319)	(0.2450)	(0.2148)	(0.2350)	(0.2311)	(0.2426)	(0.2457)	(0.2588)

The coefficient reported is the one attached to the earthquake dummy, for each dependent variable and specification. Robust standard errors in parenthesis. Controls for sector (four-digit), incorporation year, and district included in OLS and PSM. Significance at: 1%; 5%; 10%

Table 4 Earthquake effect inside/outside districts: results

Dependent variable	Regressor	Years: 2010/2011	
		2012	2013
Δ ln(turnover)	District dummy (d)	−0.0039 (0.0109)	−0.0149 (0.0138)
	Earthquake dummy (e)	−0.0094 (0.0154)	0.0206 (0.0200)
	e · d	−0.0254 (0.0225)	−0.0109 (0.0289)
	e + e · d	−0.0348** (0.0166)	0.0100 (0.0211)
Δ ln(tangibles)	District dummy (d)	0.0103 (0.0107)	0.0049 (0.0142)
	Earthquake dummy (e)	0.0055 (0.0155)	0.0334 (0.0230)
	e · d	−0.0087 (0.0228)	−0.0065 (0.0322)
	e + e · d	−0.0033 (0.0170)	0.0269 (0.0229)
Δ debt/sales	District dummy (d)	0.0025 (0.2484)	−0.0100 (0.3038)
	Earthquake dummy (e)	0.0711 (0.3773)	0.1863 (0.4548)
	e · d	1.336** (0.5538)	1.668** (0.6683)
	e + e · d	1.407*** (0.4103)	1.855*** (0.4982)
Δ ln(value added)	District dummy (d)	−0.0026 (0.0115)	0.0016 (0.0136)
	Earthquake dummy (e)	−0.0263 (0.0185)	0.0042 (0.0212)
	e · d	−0.0366 (0.0262)	−0.0236 (0.0299)
	e + e · d	−0.0629*** (0.0190)	−0.0194 (0.0216)

Robust standard errors in parenthesis. Significance at: 1%; 5%; 10%. Regressions include sector (four-digit) dummies and year of incorporation

Table 5 Earthquake effect inside/outside districts: results

Dependent variable	Regressor	Years: 2010/2011	
		2012	2013
Δ ln(production)	District dummy (d)	−0.0020 (0.0102)	−0.0054 (0.0129)
	Earthquake dummy (e)	−0.0097 (0.0150)	0.0230 (0.0189)
	e · d	−0.0358 (0.0213)	−0.0183 (0.0270)
	e + e · d	−0.0455 (0.0153)	0.0047 (0.0196)
Δ ROE	District dummy (d)	−0.3928 (0.4786)	0.9712 (0.4959)
	Earthquake dummy (e)	−0.5294 (0.8098)	1.139 (0.7810)
	e · d	0.0980 (1.123)	−1.554 (1.123)
	e + e · d	−0.4314 (0.7963)	−0.4155 (0.8241)
Δ ROS	District dummy (d)	−0.0418 (0.1965)	−0.0097 (0.2172)
	Earthquake dummy (e)	−0.3433 (0.3264)	0.3435 (0.3516)
	e · d	−0.3730 (0.4508)	−0.4895 (0.4797)
	e + e · d	−0.7163 (0.3192)	−0.1460 (0.3354)

Robust standard errors in parenthesis. Significance at: 1%; 5%; 10%. Regressions include sector (four-digit) dummies and year of incorporation

Table 6 Earthquake effect inside/outside districts: FE estimator

Dependent variable	Regressor	Years: 2010/2011	
		2012	2013
Ln(turnover)	District dummy (d) · time dummy (t)	0.0026 (0.0104)	−0.0056 (0.0136)
	Earthquake dummy (e) · time dummy (t)	−0.0083 (0.0175)	0.0186 (0.0197)
	e · d · t	−0.0358 (0.0241)	−0.0304 (0.0286)
	e · t + e · d · t	−0.0441*** (0.0166)	−0.0118 (0.0207)
Ln(tangibles)	District dummy (d) · time dummy (t)	0.0167 (0.0106)	0.0155 (0.0141)
	Earthquake dummy (e) · time dummy (t)	0.0048 (0.0154)	0.0322 (0.0234)
	e · d · t	−0.0130 (0.0226)	−0.0107 (0.0324)
	e · t + e · d · t	−0.0082 (0.0166)	0.0214 (0.0223)
Debt/sales	District dummy (d) · time dummy (t)	0.0735 (0.2424)	0.0583 (0.2945)
	Earthquake dummy (e) · time dummy (t)	0.1706 (0.3697)	0.2849 (0.4767)
	e · d · t	1.229 (0.5424)	1.477*** (0.6715)
	e · t + e · d · t	1.400*** (0.3968)	1.761*** (0.4802)
Ln(value-added)	District dummy (d) · time dummy (t)	0.0044 (0.0114)	0.0099 (0.0134)
	Earthquake dummy (e) · time dummy (t)	−0.0253 (0.0185)	0.0046 (0.0211)
	e · d · t	−0.0401 (0.0261)	−0.0291 (0.0296)
	e · t + e · d · t	−0.0655*** (0.0184)	−0.0245 (0.0208)

Robust standard errors in parenthesis. Significance at: 1%; 5%; 10%

5 Closing Remarks

In this work, we developed a firm-level empirical analysis to evaluate the impact on firm performances of a sequence of earthquakes occurred in 2012 in the Italian region of Emilia-Romagna. This study addresses the question of whether the localization of a firm within an industrial district mitigated or exacerbated the impact of a local natural disaster.

Our findings suggest that the earthquake reduced turnover, production, value added, and return on sales of the surviving firms, at least in the short term. In addition, the debt over sales ratio grew significantly more in the firms located in the areas affected by the earthquake.

Table 7 Earthquake effect inside/outside districts: FE estimator

Dependent variable	Regressor	Years: 2010/2011	
		2012	2013
Ln(production)	District dummy (d) · time dummy (t)	0.0019 (0.0101)	0.0013 (0.0128)
	Earthquake dummy (e) · time dummy (t)	−0.0116 (0.0149)	0.0204 (0.0188)
	e · d · t	−0.0451** (0.0210)	−0.0359 (0.0268)
	e · t + e · d · t	−0.0566*** (0.0148)	−0.0155 (0.0198)
ROE	District dummy (d) · time dummy (t)	0.2851 (0.4725)	1.046** (0.4912)
	Earthquake dummy (e) · time dummy (t)	−0.6541 (0.7976)	1.038 (0.7755)
	e · d · t	−0.1384 (1.103)	−1.979* (1.111)
	e · t + e · d · t	−0.7925 (0.7616)	−0.9412 (0.7955)
ROS	District dummy (d) · time dummy (t)	0.0037 (0.1922)	0.0920 (0.2112)
	Earthquake dummy (e) · time dummy (t)	−0.4211 (0.3218)	0.3739 (0.3458)
	e · d · t	−0.3526 (0.4426)	−0.5904 (0.4693)
	e · t + e · d · t	−0.7737** (0.3039)	−0.2166 (0.3172)

Robust standard errors in parenthesis. Significance at: 1%; 5%; 10%

The empirical evidence also suggests that the negative impact of the earthquake was slightly higher for the firms located in industrial districts than for those outside such areas, thereby suggesting that, at least in the short term, the usually positive cumulative processes associated with localization within an agglomerated area could have reversed and magnified the negative impact of a disruptive exogenous supply shock. In this sense, counting on the "miraculous" properties of the industrial district to absorb the devastating effects of a natural disaster risks may be a mistake. This is probably the main contribution of this chapter to the industrial district debate.

Some policy implications can be drawn from our analysis. First, since the economic impact of a local disaster can be "small" (as in our case), public institutions should avoid misallocating public resources to finance interventions for areas hit by a natural disaster, without a serious and rigorous analysis of the real impact of the event. Second, these public policies should discriminate their interventions taking into account also of the localization within a region of industrial districts. Our evidence shows that, within these local productive systems, the effects of a local disaster can be amplified. Finally, these public interventions should also account for indirect effects. These effects can be propagated through vertical relationships/

supply chain networks typical of clusters/industrial districts and more generally of agglomerated areas.

Three final caveats are in order. First, our analysis refers to surviving firms. This approach understates the overall impact of the earthquake, as it neglects its impact on firms' survival probabilities and fails to capture the effects of participating in an industrial district to the likelihood of surviving to the shock. Second, we do not account for differences in the intensity of the earthquake in different geographical areas and model instead the earthquake as a binary treatment. This can bias some of the results in case of a systematic relation between the severity of the earthquake and some of the characteristics under study (and the bias can actually go both ways and cannot be easily inferred). Third, we do not control for the extent and timeliness of public intervention in the different areas. In fact, one could even argue that it is the readiness and appropriateness of such intervention the main reason behind the mild impact of the earthquake on firms' profitability we found.

Our future research will be therefore devoted to overcome these limitations. In particular, we plan to (1) estimate the impact of the earthquake on firms' survival to come to an estimate of its overall effect on firms' profitability; (2) account for possible systematic relations between firms' characteristics (e.g., the fact that they belong to an industrial district) and the severity of the earthquake, so as to check the robustness of our results, by using data on the intensity of the earthquakes across the different municipalities; and (3) control for the extent and timeliness of public intervention in the different locations, so as to come to an estimate of its effectiveness and obtain also an estimate of the impact of the earthquake net of public support. We believe that these developments can offer new insights not only for the debate on the economic impact of natural disasters but also for the discussion on the mechanisms underlying the functioning of an industrial district.

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Coping with Economic Crisis: Cluster Associations and Firm Performance in the Basque Country

Isabel González-Bravo, Santiago M. López, and Jesús M. Valdaliso

Abstract Economic crises, such as that which started in 2007, increased business turbulence and threaten firms' survival in many different ways. Economic instability plays a role akin to a natural selection mechanism, allowing the best performing and most competitive firms to survive. The aim of this work is to analyse to what extent firms belonging to cluster associations can "shelter" from adverse economic scenarios, and promote a better recovery, when economic conditions begin to improve. The paper analyses the performance of 405 firms that operate in key sectors, covered by five cluster associations in the Basque Country region of Spain, during the years 2011–2014. We employ seven performance ratios commonly used to measure firms' economic and financial conditions to check if operating performance, during a period of economic instability, presents significant differences between affiliated and non-affiliated firms that may result in higher adaptation, and resilience, of the former ones. The results suggest that associationism does indeed provide certain advantages in periods of economic growth in the wake of a recession. There is a positive and significant relationship between membership of a cluster association and certain performance indicators, mainly sales growth. The affiliated companies perform better even in adverse economic environments, retaining their ability for differentiation, compared to non-affiliates, and, furthermore, this capability would be bolstered when the recovery begins.

Keywords Clusters · Crisis · Two-step cluster · Firm performance

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1 Introduction

At some time, all organisations suffer from periods of economic instability, caused by external and/or internal forces (Krueger and Willard 1991; Burbank 2005). Operational or strategic problems can cause structural deficiencies that lead to an enterprise's failure or even its demise. In other cases, volatile economic environments or periods of recession may threaten an enterprise's survival, if they are not properly managed and even more if they coincide with operational and/or strategic issues. Although it is not possible to gauge the extent to which external forces cause enterprises to fail, there is evidence that shows that the percentages of business failures vary in certain environments (Bruno et al. 1987) and that the boundary of such failure shifts depending on economic cycles (Neophytou and Mar Molinero 2005). Along these lines, Amat (2010) specifically contends that during the first years following the outbreak of the 2007 global economic and financial crisis, the crisis had devastating impacts on businesses, provoking high firms' failure rates.

Economic crises, such as the one that started in 2007, increased business turbulence and threaten enterprises' survival in many different ways. Economic instability plays a role akin to natural selection, by allowing the best performing and most competitive enterprises to survive by suitably adapting to the new environment (Kahl 2001). In this vein, several studies show that those enterprises that have successfully managed to recover from tough times offer a better performance in variables such as *sales*, *profitability*, and *productivity* (Pearce and Doh 2002; Kahl 2001).

Some authors have also highlighted interfirm collaboration as a business strategy for coping with uncertainty (Child et al. 2005; Skalholt and Thune 2014) and achieving a higher rate of resilience. Business literature reports the existence of a positive relationship between the geographic concentration of enterprises, their related industries, firms' competitive advantage, and economic performance. Clusters facilitate cost management (Hsu et al. 2014), allowing enterprises to introduce economies of scale and achieve higher income efficiency (Spencer et al. 2010), giving them access to new sources of finance (Henry et al. 2006), fostering innovation processes (Li and Geng 2012), and, more generally, allowing enterprises to improve their *competitiveness*, *profitability*, *productivity*, and *growth* (Porter 1998; Bagwell 2008). Ultimately, intangible advantages, stemming from cluster affiliation, mitigate the economic risk of the enterprises involved, which is a positive outcome in times of economic instability.

The aim of this work is to analyse the extent to which cluster associations (CAs)—e.g., organisations promoting cluster development—can "shield" their affiliated companies from adverse economic scenarios and promote a better recovery when economic conditions begin to improve. The paper analyses the performance from 2011 to 2014 of 405 enterprises operating in key sectors, covered by five CAs (ACE, energy; GAIA, electronics and ICTs; FMV, maritime industries; HEGAN, aeronautics; and Papermaking) in the Spanish Basque Country—one of the regions that pioneered a cluster policy in Europe in the early 1990s. After a slight improvement in 2010, those sectors, and the Basque economy as a whole, faced a further period of crisis and uncertainty between 2011 and 2013 that seemed to be over by 2014, when many economic indicators, such as GDP per capita, returned to the levels of 2009. Before describing the variables, we need to remember that cluster policy is part of the ecosystem of innovation that, in the case of the Basque Country, has been created using funding from both the regional and the European administration, in line with what may be referred to as an "entrepreneurial state intervention" (Mazzucato 2013). Furthermore, it is associated with the notion of *Experimental Capitalism* and the development of high-tech industries (Klepper 2015).

We employ seven performance ratios commonly used to measure enterprises' economic and financial performances: *ROA*, *profit margin*, *asset turnover*, *productivity (two indicators)*, *liquidity*, and *leverage*. These ratios will allow us to verify whether operating performance, during a period of economic instability, records significant differences between (cluster) affiliated and non-affiliated companies.

A preliminary exploratory study, through two-step cluster analysis, reveals the existence of differences between cluster affiliated and non-affiliated companies, according to the seven aforementioned performance ratios. However, these findings have not found a relationship of causality between the two variables. In other words, do cluster affiliated companies record better results because they belong to a CA or, the other way round, because the most efficient and productive enterprises are the ones that tend to be affiliated to CAs? The second part of this paper seeks to analyse this issue. Our findings show that, in the period studied, there is a positive relationship between cluster affiliation and firm sales which will ultimately improve the other ratios considered.

2 Cluster Affiliation and Resilience in Turbulent Economic Scenarios

When a volatile economic environment poses a major threat by triggering a recession, enterprises need to make strategic decisions in order to adjust effectively. Nevertheless, external conditions do not have the same impact on industrial sectors across the economy or within the same sector (Bruno et al. 1987).

One might assume that belonging to a CA may be one of those inherent characteristics that confer upon enterprises' certain advantages, and strengths, when facing and coping with recession scenarios. CAs do indeed promote cooperation among their members, but they also encourage them, and the cluster as a whole, to be competitive within a context of global competition (Porter 1998; Newlands 2003). The underlying theory suggests that the geographic concentration of interrelated enterprises and industries leads to a gain of competitive advantages in those businesses and improves their financial results. The localisation in a cluster allows a reduction of production and transaction costs (Hsu et al. 2014), implementing economies of scale, achieving higher earnings (Spencer et al. 2010), stimulating innovation processes (Li and Geng 2012), and, in general, obtaining benefits such as improvements in *competitiveness*, *profitability*, *productivity*, and *growth* (Bagwell 2008). Affiliated companies will be in a position to compete in better conditions than the unaffiliated, when the environment is stable, and these advantages are expected to be upheld when the economic conditions are not the most ideal ones. The advantages gained should reinforce an enterprise's position when it needs to adjust to crisis, as those advantages permit it to compete with a greater capacity for reducing costs, when faced with lower demand, but also because they ensure greater efficiency and higher level of activity, which have been considered typical features of enterprises undergoing a recovery process.

Sundry investigations have shown the advantages over the nonassociated firms that enterprises affiliated to a CA have obtained in such aspects as *productivity* and *competitiveness* (Aranguren et al. 2014; Franco et al. 2014). Li and Geng (2012) confirmed the possible differences in the performance of enterprises located inside a cluster against those located outside. The study by Aranguren et al. (2014) also showed that enterprises belonging to CAs are more productive. These results do indeed suggest that affiliated companies compete and adapt better in adverse situations.

Nevertheless, the results cannot be considered conclusive. Enterprises belonging to a CA perform better in variables such as *job creation* and *sales* (Spencer et al. 2010), but both these are overall indicators of an enterprise's level of activity, and not so much of its *productivity* and competitive advantage. Moreover, even studies such as those by Kalafsky and Macpherson (2002), and McDonald et al. (2007), which have looked at variables based on growth in sales and employment, have not found a significant relationship between cluster memberships and performance. In contrast, variables that better reflect firm competitiveness, such as labour output, returns such as *ROA* and *ROS*, and innovation (Li and Geng 2012; De la Maza et al. 2012; Aranguren et al. 2014), reveal the possible existence of a positive relationship. Yet in many cases, there are also other factors that appear to be involved, together with CA membership, in the achievement of greater competitiveness.

Although there are no conclusive results regarding the existence of a causality between CA membership and financial performance, sundry studies posit that CA membership does have effects of an intangible nature, which are not manifested in the short term, and may indirectly have economic implications for the firm (Bell et al. 2009; De la Maza et al. 2012; Aranguren et al. 2014). Specifically, the theory of the resource-based view of the firm states that the ultimate competitive advantage of an affiliated company, as opposed to the one that is not, lies in the possibility of sharing a broad range of resources and capabilities (Li and Geng 2012). Firm performance is determined by factors such as a better access to sources of finance (Henry et al. 2006; Skalholt and Thune 2014), implementing economies of scale, better access to information and labour, and the typical benefits to be gained when enterprises complement one another (Porter 2003; Navickas and Malakauskaite 2009), sharing information on key areas of management, such as marketing, finances, innovation, and technology (Hall and Teal 2013). These intangible advantages provided by membership of a CA mean that affiliated companies compete asymmetrically with their non-affiliated counterparts, which ultimately gives them a competitive advantage also in a volatile economic environment that calls for a rapid adjustment.

Moreover, scenarios of economic crisis may constitute a handicap for innovation processes by limiting the capacity for accessing resources, but they also offer new opportunities and a fertile ground for innovation (Harfi and Mathieu 2009; Antonioli et al. 2013). Sharing the costs of R&D activities may be a major driver in periods of economic turbulence (Skalholt and Thune 2014). This means that the strengths clusters have are in their greater ability to access funds, as well as in the ability to organise cooperative R&D activities.

Larger enterprises tend to be more prone to join CAs (de la Maza et al. 2008), and, generally speaking, large and productive enterprises are more resilient to volatile situations (Martin et al. 2013; Altman and Hotchkiss 2006). In fact, *size* is a variable that informs about firm performance and *productivity* (Lee 2009; Niresh and Velnampy 2014).

Few studies have analysed the effect that membership has on cluster firms in times of crisis (Skalholt and Thune (2014). Their results show that clusters reduce uncertainty in times of crisis and permit better access to certain resources, such as financing. In contrast, Martin et al. (2013) report that the competitiveness of affiliated companies in recession suffers more than that of non-affiliated. Specifically, during the 2008–2009 crisis, enterprises belonging to clusters did not appear to maintain their advantages, which are generally manifested in higher export flows. The authors attributed this to the dependence that companies, within the clusters, had on the "leaders", which are immediately affected. These results suggest that in situations of crisis, affiliated companies that are small may be highly dependent on the larger ones.

We may formulate the following hypotheses:

H1 During times of economic adjustment, CA enterprises will adapt better to crisis than those that are not affiliated.

H2 During periods of economic recovery, CA enterprises will record better results in performance than those that are not affiliated.

H3 Firm size impacts upon the adjustment process during recessions.

3 Sample and Variables

The analysis has involved a sample of 405 enterprises operating in the Basque Country specialised in those industrial sectors mentioned earlier: ACE, FMV, GAIA, HEGAN, and Papermaking cluster (Table 1). Out of the 405 enterprises, 90 were affiliated at the beginning of the period analysed and have remained so during the years under study. The analysis addressed the periods 2011–2014, following the recession of 2007. The Basque economy recorded further downturns in 2012 and 2013, with an improvement finally in 2014. The years of recession

Table 1 Distribution of the Basque enterprises studied. Affiliated/non-affiliated

Cluster association	Total enterprises	Affiliated companies	
GAIA (electronics and information technologies)	300	65	21.6%
ACE (energy)	39	6	15.4%
Papermaking (paper Tech.)	34	5	14.7%
FMV (maritime industries)	23	12	52.2%
HEGAN (aeronautics and aerospace)	9	2	22.2%
	405	90	22.2%

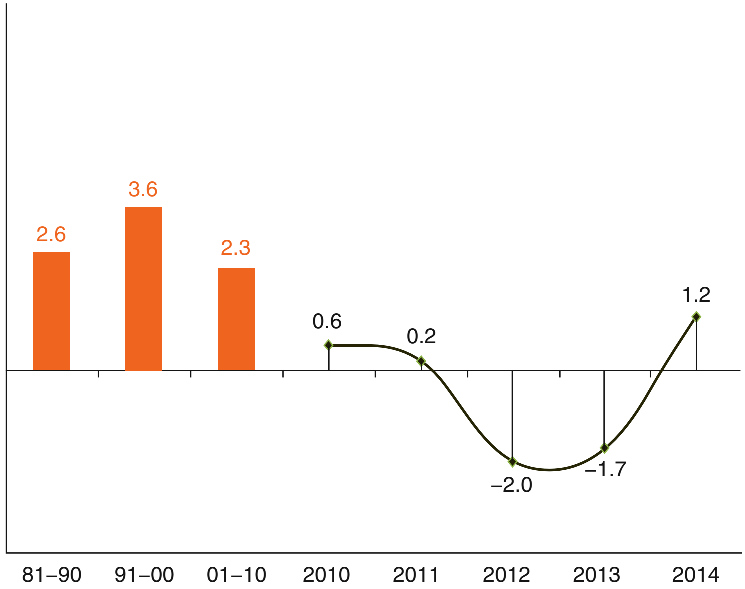

Fig. 1 Evolution of GDP in the Basque Country

recorded a significant fall in economic activity which is reflected in a fall of GDP, employment, industrial output, and sales, creating an adverse environment. In 2014, the rate of GDP growth, while not high, was the best of the last 6 years, driven mainly by the increase of the domestic demand (Basque Directorate for the Economy and Planning 2015). The graphs (Figs. 1 and 2) show the evolution of the Basque Country's main macroeconomic figures.

The analysis of firm performance has involved seven indicators that are generally associated with an enterprise's economic and financial stability or growth: *ROA*, *profit margin*, *asset turnover*, *productivity (two indicators)*, *liquidity*, and *leverage*. They are all variables that can be used to detect and assess firms' performances and therefore the possible existence of differences between affiliated and non-affiliated

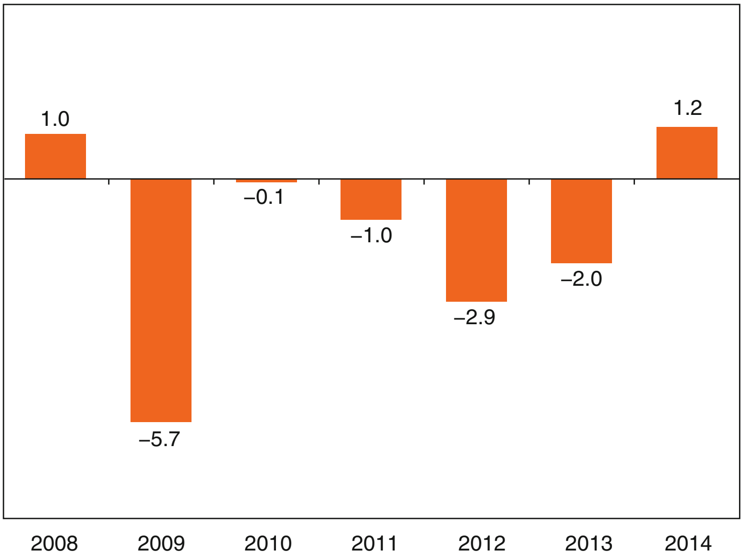

Fig. 2 Evolution of Domestic Demand in Basque Country. Source: Basque Government, Directorate for the Economy and Planning (2015)

Table 2 Variables used in the analysis

Indicator	Variables
ROA (*return on assets*)	Earnings before interest and taxes (EBIT)/ total assets
Profit margin	Earnings before interest and taxes (EBIT)/ sales
Asset turnover	Sales/total assets
Productivity_1	Value added/employees
Productivity_2	Sales/employees
Liquidity	Current assets/current liabilities
Leverage	Shareholder equity/total liabilities

companies. Table 2 provides the definitions and components for each one of these indicators.

ROA provides a basic measure of firm performance from an economic perspective. *ROA* is broken down into a further two key indicators, namely, *profit margin* and *asset turnover*. Both are suitable for measuring performance and for reporting on the efficiency, capability, and optimality of the investment (González-Bravo and Mecaj 2011; Pearce and Robbins 1993; Smith and Graves 2005; Jostarndt 2006; Kahl 2001; Routledge and Gadenne 2000).

Liquidity and *leverage* are linked to the enterprise's financial structure and enable us to appraise its self-sufficiency and solvency, as well as its ability to attract additional funds or renegotiate its debts. The two *productivity* indicators selected—*value added/employees* and *sales/employees* (Martin et al. 2011; de la Maza et al. 2012; Aranguren et al. 2014)—can offer some dynamic view about the

Table 3 Distribution of the mean values for *size*, *activity*, and *results*

	Assets	Employees	EBIT	Net income	Value added	Sales
2011. Mean data (in thousands of euros, except for Employees)						
CA companies	593,374	133	29	2407	23,209	119,679
NCA companies	85,905	51	7581	5562	13,805	51,694
Total enterprises	198,675	69	5902	4861	15,895	66,802
2014. Mean data (in thousands of euros, except for Employees)						
CA companies	702,944	136	12,518	5042	26,667	134,871
NCA companies	107,344	51	5432	3369	12,632	26,634
Total enterprises	237,386	70	6968	3725	15,669	50,386

CA companies: enterprises that belong to a cluster association
NCA companies: enterprises that do not belong to a cluster association

positive effect that CA companies have realised. Finally we measured *net income* (revenue after taxes) and *EBIT* (earnings before interest and taxes).

3.1 Characteristics of the Enterprises Analysed

We will focus here on various dimensions: *size* (assets and employees), *level of activity* (value added and sales), and *results* (EBIT and net income). Table 3 contains the mean values of the variables for each one of the groups of enterprises studied: affiliated and non-affiliated.

We can observe that both for 2011 and 2014, CA companies record much higher performances (measured by mean value) especially for those indicators linked to the variable *size* (measured by two proxies: assets and employees), reinforcing the hypothesis that CA enterprises localised in business clusters are of larger size and are characterised by a higher *level of activity* (income from sales and value added), (de la Maza et al. 2008; Aranguren et al. 2014). This result could also be explained initially by the size effect rather than by CA membership, since size leads to many advantages and it is considered one of the factors determining performance. Nevertheless, there is no overall consensus on the intensity and direction of the possible cause-effect relationship between the two variables (Niresh and Velnampy 2014).

In dynamic terms, moving from 2011 to 2014, the affiliated companies have performed better in terms of assets, employees, sales, value added, and net income. The greatest effect may be seen in EBIT, which more than doubles the figure recorded by non-affiliates.

Although affiliated companies appear to obtain advantages in variables related to the level of activity, the individual indicators linked to *profitability* and *productivity* need to be analysed in order to verify whether there are differences in performance during the period analysed with regard to non-affiliated companies.

In order to discover whether there are possible differences a priori between both groups of enterprises, as well as in the patterns of behaviour and evolution, an initial exploratory investigation has been conducted through a two-step cluster analysis (Chiu et al. 2001). This methodology reveals the natural groupings of individuals, according to certain specific variables that could not otherwise be detected. This procedure is characterised by the ability to manage both categorical and continuous variables, the automatic selection of the number of clusters (homogeneous groups), and the ability to analyse large data files. The Bayesian information criterion (BIC) (Schwarz 1978) has been used to determine the number of suitable groups being computed for each possible solution of the number of clusters. The Schwarz's Bayesian criterion considers that the model's best fit is achieved with the smallest BIC value.

4 Results

4.1 Performance of Affiliated and Non-affiliated Companies During the Adjustment Process

The two-step cluster procedure identified three groups for 2011, 2013, and 2014 and four for 2012. Nevertheless, as shown in Table 4, the results evidence the existence of two main groups of enterprises over the 4 years and analysed: a clearly differentiated group of affiliated companies (CA), on the one hand, and of non-affiliated ones (NCA), on the other (see bold percentages Table 4).

The concentration from the start of the two types of enterprises into two groups allows us to consider the existence of clear intergroup differences and strong intragroup similarities. Although the analysis identifies other groupings that could include all the other affiliated and non-affiliated companies, they involve insignificant percentages.

The interpretation of each one of the groups has involved an analysis of the centroids for each one of the variables. This analysis permits us to profile the characteristics of each one of the groupings and reveal the extent to which there are differences between the enterprises belonging to each one of them (Table 5).

In 2011, non-affiliated companies have a greater *asset turnover* and higher value added. Affiliated companies perform better in terms of income from sales, and they carry less debt. Regarding *profit margin*, *ROA*, and *liquidity*, the two groups of enterprises have very similar values.

In 2012, when the economy, in the Basque Country, reached the lowest point, the differences in favour of non-affiliates are observed in practically all the performance-related indicators. By contrast, affiliated companies are better positioned from a financial perspective, with greater *liquidity* and a better debt ratio, although the gap has narrowed regarding the group of non-affiliates.

In 2013, there is a change in favour of the affiliated companies, whereby they have become more productive and stronger from a financial perspective (greater *liquidity* and less debt). Non-affiliated companies prevail solely in the indicator of

Table 4 Results of firm distribution according to a two-step cluster analysis

2011			2012			2013			2014		
Cluster group	NCA	CA	Cluster group	NCA	CA	Cluster group	NCA	CA	Cluster group	NCA	CA
1	4.76	3.33	1	**92.06**	0.00	1	0.00	**97.78**	1	**93.59**	0.00
2	**95.24**	0.00	2	0.95	8.89	2	3.17	2.22	2	6.41	3.80
3	0.00	**96.67**	3	6.98	0.00	3	**96.83**	0.00	3	0.00	**96.20**
			4	0.00	**91.11**						

Table 5 Centroids of the groups for each one of the variables

		2011			2012				2013			2014		
Variables	Groups	1	2	3	1	2	3	4	1	2	3	1	2	3
Profit margin	Mean	−0.94	0.04	0.03	0.04	−1.22	−0.33	0.01	−0.03	−9.39	−0.02	0.01	−1.31	0.05
	Std. dev	3.38	0.19	0.15	0.19	2.67	0.78	0.19	0.33	23.22	0.43	0.25	2.82	0.18
ROA	Mean	−0.03	0.03	0.04	0.03	−0.01	−0.31	0.02	0.00	0.22	−0.01	0.02	−0.37	0.03
	Std. dev	0.94	0.14	0.09	0.13	0.26	1.04	0.11	0.14	2.22	0.18	0.14	0.82	0.15
Asset turnover	Mean	2.14	1.48	1.17	1.33	0.81	4.31	1.17	1.06	3.65	1.38	1.34	2.85	1.12
	Std. dev	3.12	1.10	0.71	0.90	1.21	4.23	0.66	0.74	4.85	1.10	0.93	2.66	0.76
Productivity_1	Mean	1038.94	84.43	69.18	81.16	1875.27	70.69	63.44	89.16	1417.74	82.79	77.92	944.58	83.92
	Std. dev	3342.22	184.78	101.40	164.35	4289.14	182.41	72.75	228.74	4086.02	170.79	137.92	3226.98	121.06
Productivity_2	Mean	3151.87	209.36	253.06	209.22	5663.99	133.81	153.60	242.23	4435.90	201.56	184.76	2621.79	285.47
	Std. dev	8219.52	452.18	723.56	487.11	8973.69	341.71	275.40	759.05	8682.07	473.56	306.52	7033.65	810.32
Liquidity	Mean	11.04	2.21	2.22	2.24	6.66	1.44	2.28	2.66	5.93	2.24	2.47	15.78	3.49
	Std. dev	19.97	1.95	1.97	1.85	10.28	1.61	1.67	2.65	14.31	2.02	2.76	67.78	8.03
Leverage	Mean	171.01	62.48	57.33	59.38	61.73	256.90	54.12	56.33	343.23	62.84	57.87	186.42	54.33
	Std. dev	251.87	37.39	23.47	37.63	35.97	392.98	21.33	23.95	512.43	50.16	38.42	199.65	24.30

Note: see Table 4 for the number of cluster group in which CA and NCA appear

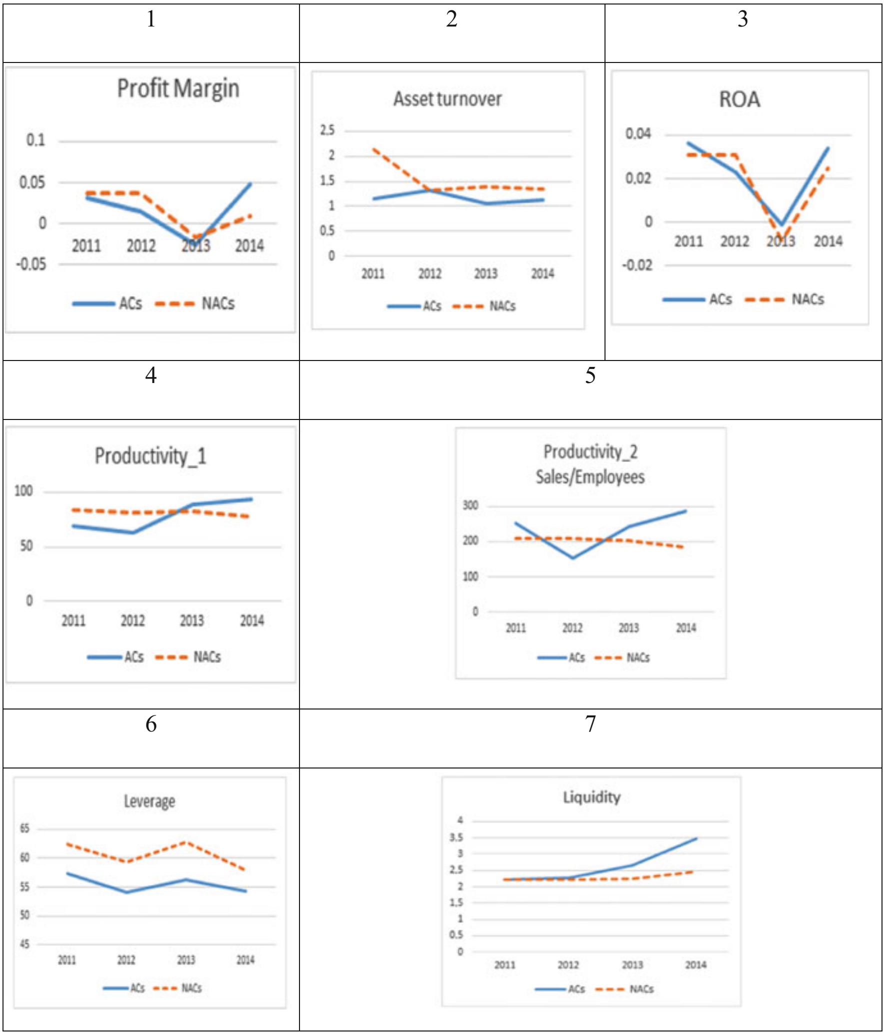

Fig. 3 Means of the groups' centroids for each variable. Source: Table 5

income from sales per unit invested. However, all enterprises report some losses from an economic perspective.

In 2014, with the exception of the *asset turnover* indicator, affiliated firms show a better financial perspective compared to non-affiliates. They emerge stronger from the years of the recession.

For a better understanding of the two trends, we report the following graphs (Fig. 3, 1–7) containing the positioning of the centroids in each year.

The graphs provide a clear snapshot of the evolution followed by the two groups of enterprises over the period analysed. The affiliated companies record a better recovery, in the final years, following the general trend of the Basque economy, with the exception referred to the variable *asset* (a variable which is conditioned by the size of the investment in assets). Regarding the variables that are representative of *productivity*, non-affiliated companies maintain stable levels over the entire period. This evidence coincides with the findings in the study by Martin et al. (2013). During the periods 2013–2014, CA membership companies showed a better performance in all indicators associated with *profitability* and *productivity*.

4.2 Significant Variables for Forming Groups

Although centroids allow us to profile the main features of one group of enterprises over another, the two-step cluster analysis also provides an opportunity to compare each variable's level of significance for the forming of cluster groups, through a Chi-square for the categorical variables and a Student's *t*-test for the continuous variables. The graphs in Fig. 4 report these variables for each year and each group, mainly containing the affiliated and non-affiliated companies, according to the percentages of classification mentioned in Table 4. The variables in these graphs are plotted by order of importance.

The vertical dotted lines show the value used to determine whether a variable is significant. If the variable's *t*-statistic exceeds this line, in both a positive and negative direction, this variable will be identified as making a significant contribution to the formation of this specific group. When the variable's *t*-statistic records negative/positive values (toward the left/right of the graph), it means the values for that group of enterprises are generally above/below the mean. Those variables that do not reach the dotted lines are not important for the formation of the groups. The graphs can therefore be used to confirm, or not, the trends observed in the first of the groups' centroids.

Those CA enterprises are characterised by having a *profit margin*, and once the economy begins to recover, affiliated companies are also defined by a higher *profit margin* in 2014. If there is one weakness that characterises affiliated companies, it is their low level of monetary units obtained over their level of investment (*asset turnover*). This implies that they recover the investments made much more slowly, and this circumstance can be explained mainly by the typical size of this group of enterprises.

It is confirmed that affiliated companies have a much stronger financial structure for coping with challenging economic climates because their low levels of debt are significant in each one of these years. In turn, the *liquidity* of non-affiliated companies is also below the mean—a characteristic that becomes a vulnerability when dealing with adverse environments.

The graphs also evidence that the *productivity* of non-affiliated companies is below the mean too, and the same applies for the labour output of affiliated companies. This situation is readily explained because the analysis revealed, as already noted, the existence of a tiny cluster group that precisely involves enterprises

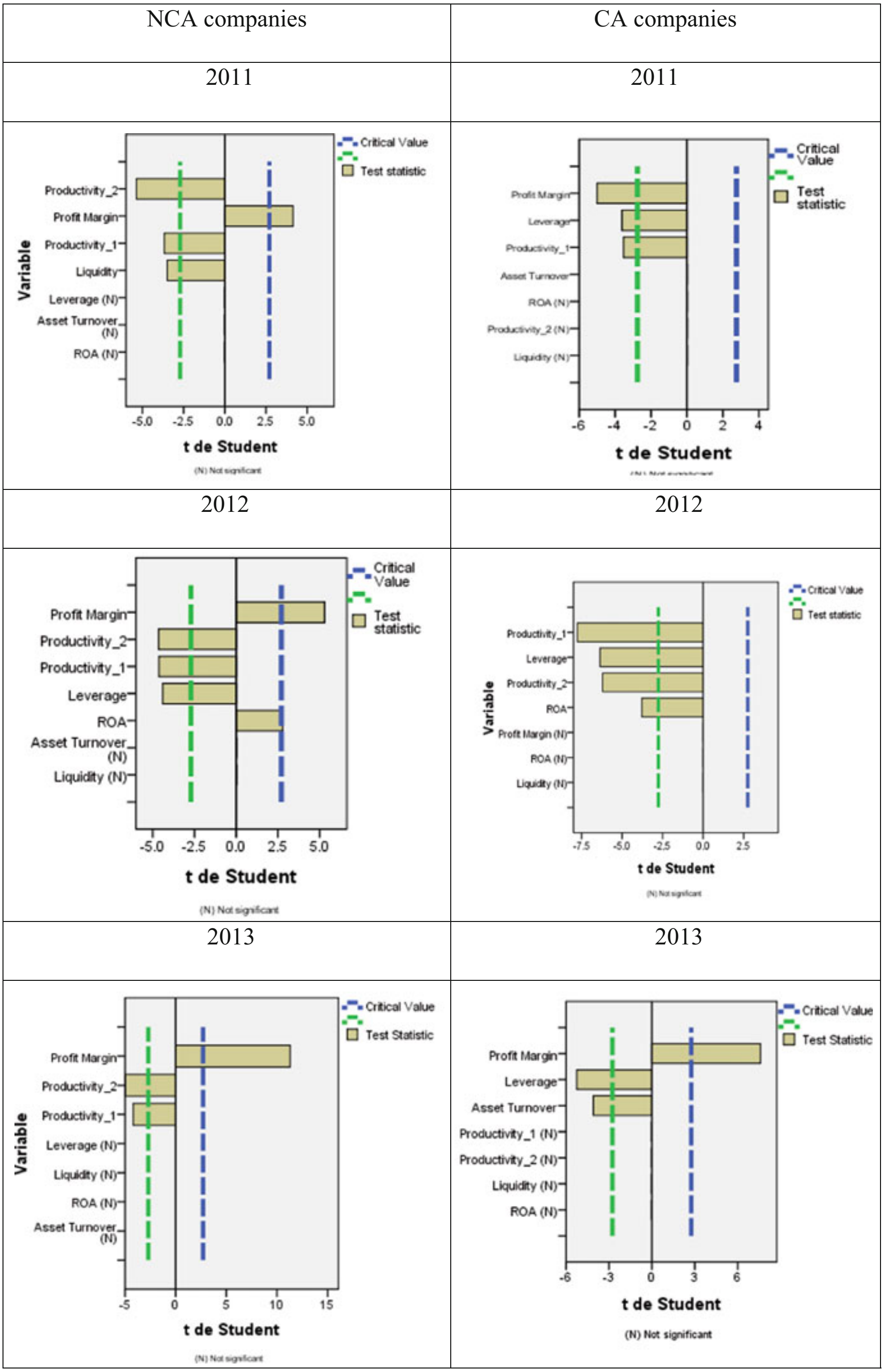

Fig. 4 Level of each variable's significance in the formation of groups

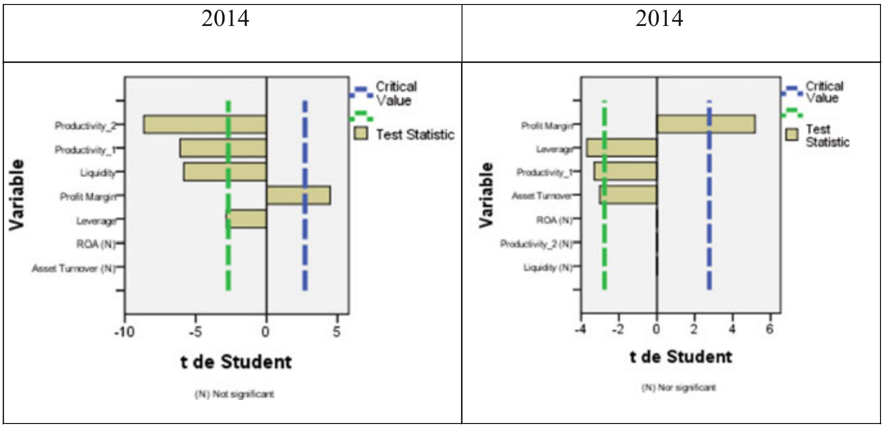

Fig. 4 (continued)

with high levels in both these indicators. They are, nonetheless, a very small number of enterprises that account for the residual percentages in both groups.

4.3 A Regression Analysis

The aim of our analysis was to confirm the significance of CA membership on performance indicators during the times of economic crisis and after the recovery. The following regression is therefore proposed:

$$\mathrm{VAR\_Ind}_{(14-11)} = \beta 0 + \beta 1^{*}\mathrm{Cluster} + \beta 2^{*}\mathrm{Size} + \varepsilon t \qquad (1)$$

where *Var_Ind* $_{(14\_11)}$ corresponds to the variation recorded in each one of the variables between 2011 and 2014. *Cluster* is a dichotomous variable that reflects membership of a CA (value 1) or not (value 0). *Size* is a variable that reflects firm size, taking values of 1–4, depending on employees' levels. The values have been assigned according to the EU criteria set forth in the Commission Recommendation of 6 May 2003, concerning the definition of micro-, small-, and medium-sized enterprises. Accordingly, *size* takes the value 1 for microenterprises with fewer employees than 10, 2 for small enterprises with fewer employees than 50, 3 for medium-sized enterprises with fewer employees than 250, and 4 for large ones with more than 250 employees.

Table 6 shows significant results only for two variables: *asset* and *productivity* (considering *sales on employees)*. The coefficients of the variable that reflects CA membership are positive. This means that affiliated companies record better results in the return on their investments and in the *productivity* of sales per employee, which would enable us to accept H2. In contrast, H1 is not confirmed in our analysis, and H3 resulted to be not significant (see Table 6).

Table 6 Regression coefficients for the significant variables

	Var_asset turnover		Var_productivity_2	
Variables	Beta	Sig.	Beta	Sig.
Cluster (1,0)	0.568	0.024	0.300	0.011
Size (1...4)	−0.183	0.120	−0.067	0.227
R square	0.016		0.018	

In contrast, the size variable appears not significant for the two variables reported in Table 6.

5 Conclusions

The aim of this work was to analyse the extent to which CA affiliation could "shield" from adverse economic scenarios, and promote a better recovery, when economic conditions begin to improve.

Once the period of economic recovery had begun, in 2014, CA affiliated enterprises recorded a significant upturn in turnover, level of activity, and operating margin, whereas non-affiliated ones recorded a downturn. This would suggest that associationism does indeed provide certain advantages, which exert their influence not during the downturn but during the recovery. This appears not to be an effect of size that in our data is not significant. Affiliated companies record better results in the indicator *value added/employees* in 3 of the 4 years analysed. It may therefore be affirmed that affiliated companies generate more wealth than non-affiliated ones. There is a positive and significant relationship between CA membership and sales. These findings are consistent with those of certain studies that focus on analysing the advantages of associationism: affiliated companies perform better in sales growth. Perhaps the most important thing to note is that this ability to generate growth in sales is what really helps affiliated companies to better adapt to recessions. The fact that sales growth is a typical characteristic of affiliated companies gives them a further advantage for competing and surviving in hostile environments.

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Italian Industrial Districts and the 2008 Recession

Giorgio Brunello and Monica Langella

Abstract Using a “difference-in-differences” approach, we show that the share of entrepreneurs in Italy declined more in industrial districts than in comparable labour markets during the 3 years following the 2008 recession. We have examined alternative explanations of this finding, thus concluding that it is consistent with the idea that intense social interactions typical of industrial districts act as a multiplier that amplifies the response to shocks. However, we cannot exclude that this may translate into a positive effect on employment as the flows from entrepreneurship to employment appear to be greater within industrial districts.

Keywords Industrial districts · 2008 Recession · Italy

1 Introduction

The effect of economic recessions on entrepreneurship is, in principle, ambiguous. By reducing income and wealth, they can lower the incentive to start or stay in business. At the same time, recessions shrink employment opportunities, and this could induce people to shift to self-employment as an alternative to inactivity and unemployment (see Fairlie 2013). Do these effects vary with local economic conditions and in particular with the presence of agglomeration economies?

This chapter summarizes and extends the empirical research reported in Brunello and Langella, 2016, Local agglomeration, entrepreneurship and the 2008 recession: evidence from Italian industrial districts, *Regional Science and Urban Economics*, 58, 104–114.

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Agglomeration economies are likely to affect economic activity and entrepreneurship, and there is ample evidence that suggests that this can be related to the presence of consumer/supplier linkages, entrepreneurial and knowledge spillovers and labour market pooling. Less is known, however, about their effects on how entrepreneurs react to recessions. In this chapter, we address this by focusing on the 2008 recession and on industrial districts, characterised by the prevalence of small- and medium-sized enterprises operating in the manufacturing sector, strong product specialisation, proximity and substantial social interactions.

Previous literature suggests that the effects of a recession on entrepreneurship can vary across comparable areas that differ in their degree of agglomeration for a number of reasons, some insulating local entrepreneurs, others favouring the propagation of the crisis. On the one hand, as remarked by Guiso and Schivardi (2007), the *social multiplier* and information spillovers, which characterise industrial districts, are likely to amplify the sensitivity to shocks (see also Glaeser et al. 2003). On the other hand, the density of industrial networks within districts may build a safety net of reciprocal support, thereby sustaining the ability to survive during a global recession. The literature on social capital suggests that industrial clusters are areas where the level of trust among people is higher (see Putnam 2000). This may facilitate the access to credit (Guiso et al. 2004b), as well as improve the economic performance of local banks, with protective effects on entrepreneurship when the local economy is in dire straits.

We run an empirical investigation, matching cross-section microdata from Northern and Central Italy,[1] where industrial districts are particularly widespread (see, for instance, Porter 1998), with local labour market indicators. Using micro-level data from the Italian Labour Force Survey from 2006 to 2011, we adopt a “difference-in-differences” setting (DiD) that compares the evolution of the share of entrepreneurs before and after the 2008 recession in two groups of travel to work areas, industrial districts (ID) and other comparable local labour markets (OLM). Local labour markets, as defined by the 2001 Italian Census, are travel to work areas, and IDs are a subset of these areas characterised by strong product specialisation and firm size homogeneity.

Our focus is on the bulk of Italian entrepreneurship, that is to say men aged 35–55[2] working in the Northern and Central areas of Italy. We find that the share of entrepreneurs has declined to a larger extent after the 2008 recession in areas with industrial districts than in other comparable labour markets. Measured in terms of the pretreatment average share, the estimated differential effect is between 5.3 and 5.7% (in absolute value), depending on the estimation method.

We discuss several mechanisms that may explain our empirical findings. Our analysis allows us to rule out several alternative explanations, including differences

[1]We decided to exclude the South of Italy from this analysis due to the lack of this type of industrial agglomerations in the area. As we will further explain in the remainder of the paper, we also exclude large urban areas and local labour markets that show a limited level of comparability to industrial districts. The reason for this is to increase precision of our estimates, although, as we will discuss including those areas that does not alter the core of our findings.

[2]This is the age range that concentrates the bulk of the entrepreneurial rate. Very few entrepreneurs are observed below the age of 35, and we excluded people aged more than 55 due to high rates of attrition to retirement.

in industrial specialisation and composition, the propensity to export and access to credit and population density; we conclude that our results are consistent with the presence of social multiplier effects, as described by Guiso and Schivardi (2007). In models where such effects are present, agents take decisions facing an uncertain environment and having limited information. The behaviour of other agents allow them to increase their knowledge, and therefore the probability of observing other entrepreneurs provides an incentive to delay adjustments. Once someone acts, the revealed information could trigger further actions and start a self-reinforcing process that prompts many agents to undertake the adjustment within a short time span. Our interpretation relies on the idea that the intense social interactions typical of industrial districts facilitate information flows, thereby amplifying the effects of a shock in closely connected economies.

The chapter is organised as follows. Section 2 presents a model of agglomeration effects during a recession. In Sect. 3 we define industrial districts and present the data. The empirical strategy is described in Sect. 4, and results are presented and discussed in Sect. 5. Conclusions follow.

2 Agglomeration Effects in the Presence of Negative Shocks: A Model

We illustrate the economic interactions between local agglomeration effects, entrepreneurship and recessions using a simple economic model, which draws from Lucas' model of entrepreneurial choice (see Lucas 1978; Guiso and Schivardi 2011, for a recent application).

2.1 Setup

Consider an economy composed of two local labour markets (or localities) that differ in their degree of agglomeration, captured by λ, with $\lambda \geq 1$. Agglomeration effects originate from individuals and/or firms locating near each other in an area (see, for instance, Rosenthal and Strange 2003; Puga 2010). Geographical proximity creates externalities. The localization patterns of firms can either generate Marshall-Arrow-Romer (MAR) externalities, when industries specialise geographically and produce knowledge spillovers, or Jacobs externalities, driven by industrial diversification (Glaeser et al. 1992). The benefits associated to these externalities are a source of agglomeration effects.

In our model we assume that the sole source of agglomeration is the presence of an industrial district, where MAR externalities prevail and product specialisation contributes positively to agglomeration both by facilitating information flows among network members and by accelerating learning (Guiso and Schivardi 2011), which raises productivity. For simplicity, we posit that only locality 1 is endowed with an industrial district, while the other area is not characterised by any particular type of industrial agglomeration.

We assume that the total population of individuals inhabiting each locality is normalised to 1. Following Guiso and Schivardi (2011), we also assume that entrepreneurs set up their activities in the location where they were born. Workers, on the other hand, are fully mobile. Guiso and Schivardi (2011, p. 64) argue that, "…while complete entrepreneurial immobility is clearly extreme, the fact that entrepreneurs are less mobile than employees and tend to start their business where they were born finds widespread empirical support…". They quote data from a survey of industrial districts by the Bank of Italy, as well as work by Michelacci and Silva (2007), who have shown that the vast majority of Italian entrepreneurs start a business in their place of birth.

Individuals residing in each locality are endowed with entrepreneurial ability x_f, which we posit for tractability to be uniformly distributed on the support [0, 1], and choose to become entrepreneurs if expected profits from business activity—net of the setup costs c—are at least as high as expected income from either employment or unemployment; otherwise they choose to become employees.

We assume that $\lambda_1 > 1$ and $\lambda_2 = 1$. This normalisation simplifies the algebra without loss of generality. The timeline of events in this model is as follows: at the beginning of the time period, individuals in each locality choose whether to be entrepreneurs or employees. In the former case, they set up their business in the locality where they were born. In the latter case, they are free to move between localities and find a job. After this choice, production occurs, and output is sold at given prices (normalised to 1). In each locality, production is affected by the business climate, which is either normal or hit by a negative aggregate shock (a recession). Normal times and recessions occur with probability $1 - p$ and p. Rational individuals consider the business climate in their choice of occupation at the beginning of the period.

2.2 Employment Choice in Locality 1

For brevity, we only discuss equilibrium in locality 1. Define revenue in firm f as $\lambda x_f[A + \ln(1 + k_f)]$, where k_f is employment, $g(k_f) = [2 + \ln(1 + k_f)]$ $g(k_f) = [A + \ln(1 + k_f)]$ is the production function, and x_f is entrepreneurial ability. Each firm is managed by a single entrepreneur. Agglomeration affects revenue, which is concave in employment, and positive even in the absence of employees. The business climate is captured by the additive shock ε, which is negative in a recession and equal to zero during normal times (again, a normalisation).

Expected profits for an individual with ability x_f are given by

$$\begin{aligned} E\pi_{1f} &= p\left[\lambda_1 g\left(k_f\right)x_f - k_f w - \varepsilon\right] + (1-p)\left[\lambda_1 g\left(k_f\right)x_f - k_f w\right] \\ &= \lambda_1 g\left(k_f\right)x_f - k_f w - p\varepsilon \end{aligned} \tag{1}$$

where $w \leq 1$ is for wages.[3] In line with the institutional features of the Italian labour market, we assume that wages are set at the national rather than at the local level[4] and that they vary with the shock ε. Individuals take the common wage $w = w(\varepsilon)$ as given, with w a decreasing function of ε. Maximisation of expected profits with respect to k_f yields

$$k_f = \frac{\lambda_1 x_f}{w} - 1 \tag{2}$$

Equation (2) implies that higher wages reduce employment and that, conditional on the national wage, more talented entrepreneurs run larger firms. Let Ω_1 be the threshold level of ability such that the individual with that ability is indifferent between being an entrepreneur and an employee. Under the conditions spelled out later in this section, individuals with higher ability become entrepreneurs and hire employees if $x_f > w/\lambda_1$, do not hire employees if $\Omega_1 \leq x_f \leq w/\lambda_1$ and become employees or unemployed if $x_f < \Omega_1$. For brevity, we assume that $\Omega_1 > w/\lambda_1$ so that entrepreneurs always have a positive number of employees. Since $\Omega_1 < 1$, this assumption requires that $w < \lambda_1$.

Using (2) and the approximation $\ln(1 + k) \cong k$ in the revenue function, expected profits for the entrepreneur with ability x_f are $E\pi_{1f} = w + \frac{\lambda_1{}^2 x_f{}^2}{w} - p\varepsilon$, a convex function of ability. Total employment demand D_1 in locality 1 is given by

$$D_1 = \int_{\Omega_1}^{1} \left(\frac{\lambda_1}{w}x_f - 1\right) dx_f = \frac{\lambda_1}{2w}\left(1 - \Omega_1{}^2\right) - \left(1 - \Omega_1\right) \tag{3}$$

Employees are free to find their job in either locality. Their income is equal to the national wage w if employed and to zero if unemployed. Defining the unemployment rate u as the ratio of the unemployed in the two localities to the total population, the probability of employment is $1-u$. Since total supply to the employment sector is $\int_0^{\Omega_1} dx + \int_0^{\Omega_2} dx = \Omega_1 + \Omega_2$, unemployment u is the difference between supply and demand: $u = 1 - \frac{\lambda_1}{4w}\left(1 - \Omega_1{}^2\right) - \frac{1}{4w}\left(1 - \Omega_2{}^2\right)$, an increasing function of the wage w and the thresholds Ω_i and a decreasing function of the agglomeration effect λ_1. Full

[3]This assumption is consistent with $x_f \in [0, 1]$.

[4]Wage bargaining in Italy occurs mainly at the national and sectorial level (Du Caju et al. 2009). Ammermuller (2010) find that wages in Italy do not respond to local unemployment. Guiso and Schivardi (2011) assume that the common wage is determined by the condition that national labour demand equals national labour supply.

labour mobility implies that the expected wage $Ew = w(1-u)$ does not vary with the locality.

In each locality, the choice between entrepreneurship and employment is regulated by the arbitrage condition $E\pi_i = Ew + c_i$. We assume that entry costs are lower in the more agglomerated locality so that $c_1 < c_2$ (see, for instance, Guiso and Schivardi 2011). The arbitrage condition holds in each locality, implying that $E\pi_1 + Ew - c_1 = E\pi_2 + Ew - c_2$ must be true, which yields

$$\lambda^2 {\Omega_1}^2 = {\Omega_2}^2 + (c_1 - c_2)w \tag{4}$$

Using (4) in the definition of unemployment, the expected wage Ew can be written as

$$Ew = w(1-u) = \frac{\lambda_1 + 1}{4}\left(1 - \lambda_1 {\Omega_1}^2\right) + \frac{c_1 - c_2}{4} w \tag{5}$$

2.3 Equilibrium

In locality 1, expected profits net of expected wages and the setup costs are given by

$$E\pi_1 - Ew - c = \lambda_1 x^2 \left(\frac{\lambda_1}{w(\varepsilon)} + \frac{\lambda_1 + 1}{4}\right) - \frac{\lambda_1 + 1}{4} + w(\varepsilon)\left[1 - \frac{c_2 - c_1}{4}\right] - p\varepsilon - c_1 \tag{6}$$

Assumption 1. The following two conditions hold:

$$w(\varepsilon)\left[1 - \frac{c_2 - c_1}{4}\right] - \frac{\lambda_1 + 1}{4} - p\varepsilon - c_1 < 0 \tag{7}$$

$$\frac{{\lambda_1}^2}{w(\varepsilon)} - \frac{1 - {\lambda_1}^2}{4} + w(\varepsilon)\left[1 - \frac{c_2 - c_1}{4}\right] - p\varepsilon - c_1 > 0 \tag{8}$$

Conditions (7) and (8) are sufficient to guarantee that an interior equilibrium exists. The former condition states that the individual with lowest entrepreneurial talent ($x = 0$) prefers to be an employee, and the latter condition says that the individual with highest entrepreneurial ability ($x = 1$) chooses to be an entrepreneur. When these regularity conditions hold, expected profits—net of expected wages and the setup costs—intercept the abscissa at $x = \Omega_1 < 1$. Individuals with ability above the threshold Ω_1 choose to become entrepreneurs, and individuals at or below the threshold are either unemployed or employees.

The arbitrage condition in locality 1, $E\pi_1 = Ew + c_1$, can be written as

$$\Omega_1{}^2 = \frac{\frac{\lambda_1+1}{4} - w(\varepsilon)\left[1 - \frac{c_2-c_1}{4}\right] + p\varepsilon + c_1}{\lambda_1\left[\frac{\lambda_1+1}{4} + \frac{\lambda_1}{w(\varepsilon)}\right]} \tag{9}$$

The negative shock ε affects this condition both directly, by reducing expected profits, and indirectly, by altering the wage rate. In locality 2, where $\lambda_2 = 1$, the threshold Ω_2 is given by

$$\Omega_2{}^2 = \frac{\frac{1}{2} - w(\varepsilon)\left[1 - \frac{c_2-c_1}{4}\right] + p\varepsilon + c_2}{\left[\frac{1}{2} + \frac{1}{w(\varepsilon)}\right]} \tag{10}$$

By comparing (9) and (10), we establish the following:

Result 1: $\Omega_1 < \Omega_2$. The equilibrium share of entrepreneurs is higher in the more agglomerated locality. Furthermore, the marginal entrepreneur in locality 1 is less talented than the marginal entrepreneur in locality 2.

2.4 *Comparative Statics and Agglomeration Effects*

We investigate the effects of the negative shock ε and of the degree of agglomeration λ_1 on local entrepreneurship by differentiating (9), which yields

$$\frac{\partial\Omega_1}{\partial\varepsilon} = \frac{p - \frac{\partial w}{\partial\varepsilon}\left(1 - \left(\frac{c_2-c_1}{4}\right) + \frac{\lambda_1{}^2\Omega_1{}^2}{w^2}\right)}{\Delta} \tag{11}$$

where $\Delta = \lambda_1\left[\frac{\lambda_1}{w} + \frac{\lambda_1+1}{4}\right]$ and

$$\frac{\partial\Omega_1}{\partial\lambda_1} = \frac{\frac{1}{4} - \Omega_1{}^2\left[\frac{\lambda_1}{2} + \frac{2\lambda_1}{w} + \frac{1}{4}\right]}{\Delta} \tag{12}$$

While the denominator Δ is positive, the numerator of (11) cannot be unambiguously signed. A negative shock ε has ambiguous effects on expected profits net of expected wages. On the one hand, net profits fall for any given wage; on the other hand, they increase because the shock reduces the national wage. If the former effect prevails, a negative shock reduce entrepreneurship in the locality by raising the threshold Ω_1.

Next, consider the effect of the degree of agglomeration λ_1 on the threshold value Ω_1—Eq. (12)—and assume that $\Omega_1 > 1/2$, a plausible assumption given that the share of entrepreneurs is typically below 50% of the population. Under this assumption, the numerator in (12) is negative because $\lambda_1 > w$ for the condition $\Omega_1 > w/\lambda_1$ to hold, and a higher degree of agglomeration reduces the threshold and increases the share of entrepreneurs.

Since average entrepreneurial ability in locality 1 is $E[x|x \geq \Omega_1] = 1 + \Omega_1$, an increase in the level of agglomeration λ_1 reduces $E[x|x \geq \Omega_1]$ by reducing Ω_1 and attracting less talented individuals into business. On the other hand, when $\frac{\partial \Omega_1}{\partial \varepsilon} > 0$, a negative shock that increases Ω_1 raises average entrepreneurial ability by inducing the less talented to leave their businesses.

We are particularly interested in understanding whether and how the degree of agglomeration λ_1 influences the response of local entrepreneurship to a negative shock in a recession. To investigate this, we compare the marginal effect of a negative shock on the threshold value of ability in the two localities that differ because of the presence of an industrial district, which affects agglomeration. Differentiating the arbitrage condition (4) with respect to the shock ε yields

$$\left(\frac{\partial \Omega_2}{\partial \varepsilon} - \frac{\partial \Omega_1}{\partial \varepsilon}\right) = \left(\frac{{\lambda_1}^2 \Omega_1}{\Omega_2} - 1\right)\frac{\partial \Omega_1}{\partial \varepsilon} + \frac{1}{2\Omega_2}(c_2 - c_1)\frac{\partial w}{\partial \varepsilon} \tag{13}$$

Assume that $\frac{\partial \Omega_i}{\partial \varepsilon}$ is positive. We know that $\frac{1}{2\Omega_2}(c_2 - c_1)\frac{\partial w}{\partial \varepsilon} < 0$. However, since $\frac{{\lambda_1}^2 \Omega_1}{\Omega_2} = \frac{\Omega_2}{\Omega_1} + \frac{(c_1 - c_2)w}{\Omega_1 \Omega_2}$ can be either higher or lower than 1, we cannot establish a priori whether $\frac{\partial \Omega_2}{\partial \varepsilon}$ is larger or smaller than $\frac{\partial \Omega_1}{\partial \varepsilon}$. We therefore turn to the empirical analysis.

3 The Data

The 2001 Census of Industries (Italian Statistical Institute—*ISTAT*) identifies 156 industrial districts in a set of 686 local labour markets. Based on this classification, we are able to assign people in our data set to either industrial districts or other labour markets. The definition of IDs that we use predates the 2008 recession and is therefore not affected by changes in industrial composition related to the economic crisis.

In the Census, industrial districts are local labour markets that satisfy the following criteria:

1. Specialisation in the manufacturing sector, i.e. $l_a = \frac{X_{am}/X_a}{X_m/X} > 1$ where x_{am} and x_a denote the number of manufacturing employees and total employment in area a, and $x_{.m}$ and $x_{..}$ are the corresponding figures at the national level.
2. Relative high share of small and medium firms,[5] or $s_a = \frac{x_{am}^{small}/x_{am}}{x_{.m}^{small}/x_{.m}} > 1$, where the superscript "small" indicates the number of employees in small- and medium-sized enterprises.

[5]Small and medium enterprises are defined by the European Commission as firms having less than 250 employees and an annual turnover of up to EUR 50 million or a balance sheet total of no more than EUR 43 million (Commission Recommendation of May 6 2003). Italian industrial structure is

3. Presence of a dominant manufacturing industry. Letting $l_{as} = \frac{x_{as}/x_{am}}{x_{.s}/x_{.m}}$ denote the location quotient for each specific manufacturing industry s, the dominant manufacturing industry d is such that $l_{ad} > 1$ and the level of employment is maximum among the local specialised industries. For d, the following condition must hold: $s_{ad} = \frac{x_{ad}^{small}}{x_{ad}} > 0.5$.
4. Where there is only one medium-sized enterprise, the share of employment in small enterprises must exceed half that of the medium-sized firm.

Our data are drawn from the Italian *Labour Force Survey (Italian statistical Institute—ISTAT)*, a quarterly survey on labour market conditions covering a representative sample of almost 77,000 households and 175,000 individuals per quarter. We have access to the microdata from the first quarter of 2006 to the last quarter of 2011, about 3 years before and after the start of the Great Recession, which is usually placed in the third quarter of 2008.

Using information on the place of residence, we assign individuals to local labour markets. We treat as entrepreneurs the individuals who meet all the following criteria: (i) self-employment status, (ii) decide their working time, (iii) work more than 480 hours per year, (iv) neither work exclusively on the customer's premises nor are employed by a temporary agency and (v) operate as managers, professionals or in other skilled jobs. Criteria (ii) to (iv) exclude those who report self-employment status but are working as employees. Criterion (v) is used also by Faggio and Silva (2014) and allows us to exclude the self-employed who have selected this status because alternative employment opportunities are not available.[6]

We retain only males aged 35–55 who are employed, self-employed, unemployed or inactive at the time of the interview and exclude those working in the public sector. We exclude females because of their low labour force participation; individuals younger than 35 because in several local labour markets, there are few entrepreneurs in this age group; and workers older than 55 because of their attrition into retirement.[7] Finally, we exclude Southern Italy because of its structural economic difference with the rest of the country.

Since the Labour Force Survey randomly selects a sample of municipalities, we can only identify 540 local labour markets in the data—out of a total of 686. The elimination of Southern Italy, of large urban areas[8] and of the areas outside the

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characterised by the prevalence of SME. According to the Italian Statistical Institute (ISTAT), in 2013 the average firm size in Italy is of 3.7 employees.

[6]As discussed below, using a broader definition (self-employment status) does not affect qualitatively our empirical results.

[7]The average share of entrepreneurs with employees in 2006 was 11.5% for individuals aged 35–55, 6.4 for those aged 30–34 and 3.1% for individuals aged 25–29.

[8]We exclude urban areas such as Turin, Milan, Venice, Genoa, Bologna, Florence and Rome. We exclude large urban areas and the South of Italy in order to increase the precision of our estimates. South of Italy is characterised by the lack of the industrial agglomerations we focus on in this

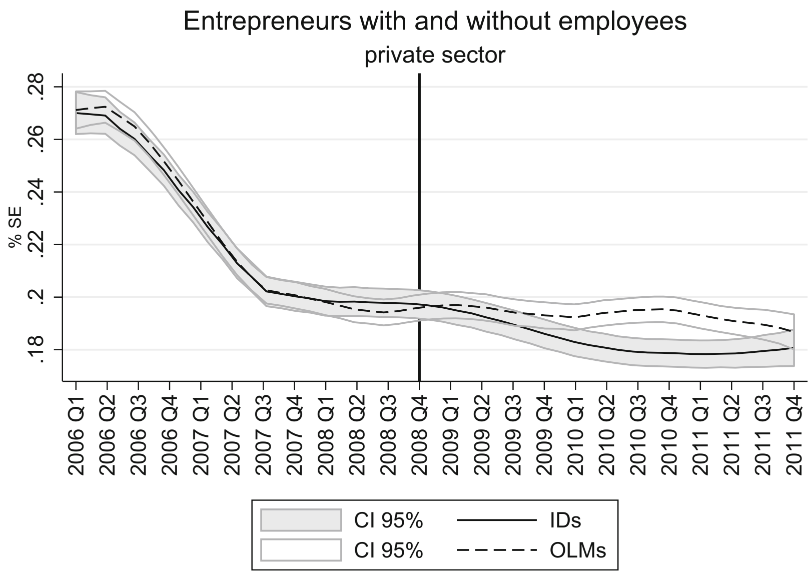

Fig. 1 Local polynomial estimates of the share of entrepreneurs in industrial districts (IDs) and other local labour markets (OLMs). Entrepreneurs with and without employees

common support further reduces the sample to 247 local labour markets, 98 with industrial districts and 149 without districts.

Figure 1 illustrates how the raw share of entrepreneurs has changed in treated and control areas during the period 2006–2011, before and after the 2008 recession. The figure shows that prerecession trends are not statistically different across treated and control areas, which supports our "difference-in-differences" strategy.[9] Before the recession, the share of entrepreneurs with and without employees was very similar in both areas. After the recession, the share remained more or less stable in control areas and declined in treated areas. Because of this, a statistically significant gap between the shares emerged in 2010 and early 2011.

4 The Empirical Model

As discussed in the Introduction, the effects of a recession can differ across comparable areas that vary in their degree of agglomeration, with some effects insulating local entrepreneurs and some others favouring the propagation of the crisis. In the

chapter, while large urban areas show a different industrial structure with respect to the rest of the country. Including those in the analysis does not substantially alter our results.

[9]Formal tests of the hypothesis that pretreatment tests are parallel are discussed below.

ensuing empirical analysis, we compare the evolution of the share of entrepreneurs before and after the 2008 recession in areas with and without industrial districts. We estimate the following equation:

$$E_{iat} = \beta_0 + \beta_1 Post2008.Q3_t * ID_{ia} + \beta_2 X_{it} + \phi_t + \lambda_a + u_{iat} \quad (14)$$

where E_{iat} is a dummy equal to one if the individual i in area a at time t is an entrepreneur (with or without employees) and to zero otherwise (employment, unemployment or inactivity); ID_{ia} is the treatment dummy that identifies the presence of industrial clusters in the local labour market; $Post2008.\ Q3_t$ is a dummy taking value one since the beginning of the 2008 recession, which we set in the fourth quarter of 2008 (see D'Amuri 2010) and zero otherwise; and X_{it} is a vector of individual level covariates, including age, education, marital status, the presence of children in the household and nationality. ϕ_t and λ_a are year by quarter and area fixed effects, respectively.

We estimate (14) using both a linear probability and a probit specification. Since neighbouring areas share a similar institutional setup, assuming that errors are independent across local labour markets is overly restrictive. Therefore, we cluster standard errors at the level of the province. The key parameter in this regression is β_1, which measures the differential effect of the recession in treated and control areas. As mentioned above, a difficulty of this empirical analysis is that geographical areas may not be completely comparable, due to intrinsic differences that are not fully captured by the degree of agglomeration measured by the dummy *ID*.

To increase the comparability between treatment and control areas, we proceed as follows. First, we estimate a probit model using our sample of local labour markets during the pretreatment period, which goes from the first quarter of 2006 to the third quarter of 2008. We regress the dummy *ID* on a set of control variables that comprises log regional real exports and GDP,[10] the local unemployment rate, the index SP of industrial specialisation, computed as $SP_{cs} = \frac{L_{cs}}{L_c}$, where L_{cs} is the sum of employees and self-employed workers in local area c and sector s, and L_c is the total number of workers in the area (Cingano and Schivardi 2004), the prevailing industrial sector, population density, dummies for the macro area (North-West, North-East or Center) and period dummies. Second, we compute the propensity score[11] and eliminate from our sample the 13 local labour markets with a propensity score falling outside the intersection of the support for the treated and the control group (Sianesi 2005). These areas are not comparable to the rest in terms of the selected vector of observables.

Applying this method, the average difference in the observables between treated and control areas after restricting the sample to the common support is reduced. Still, as reported in Table 1, important differences remain. For example, the local

[10] Regional values are from the Italian regional accounts.

[11] The propensity score is defined as $e(x) = \Pr ob(ID = 1 | X = x)$, the probability of being treated conditional on observables X.

Table 1 Summary statistics

	Industrial districts	Other local labour markets	T-test of differences (in absolute value)
Age	44.66 (5.88)	44.65 (5.92)	0.17
Native	0.90 (0.28)	0.91 (0.30)	1.55
Has children	0.64 (0.48)	0.61 (0.49)	2.63
Married	0.71 (0.45)	0.68 (0.47)	2.76
Lower secondary education	0.44 (0.50)	0.43 (0.49)	1.50
High school	0.41 (0.49)	0.42 (0.49)	0.95
University degree	0.07 (0.26)	0.09 (0.28)	2.84
log GDP	10.79 (1.02)	10.50 (0.99)	1.73
log real exports	2.20 (0.11)	2.13 (0.12)	3.03
Specialisation index	0.24 (0.07)	0.24 (0.06)	0.42
Population density	230.2 (215.4)	140.5 (121.8)	2.24
Unemployment rate	0.028 (0.02)	0.032 (0.02)	1.57

Notes: Standard deviations in parentheses

unemployment rate is 2.8% in treatment areas and 3.2% in control areas (*t*-test of the absolute difference: 1.57)[12]; regional real exports are higher on average in the areas with industrial districts (*t*-test of the absolute difference: 2.81); the percentage of individuals with a college degree is 7 and 9% in the treated and control areas, respectively (*t*-test of the absolute difference: 2.85); population density (inhabitants per 100 km^2) is significantly higher in treated areas (230.2 inhabitants per squared kilometre versus 140.5 in control areas—*t*-test of the absolute difference: 2.24); and the index of economic specialisation is 0.24, not statistically different in the two groups (*t*-test of the absolute difference: 0.42). These differences suggest that we include the vector X of control variables and of the area fixed effects in the model illustrated by Eq. (14).

5 Results

Table 2 presents our baseline results, which consist of two columns, one for the linear probability estimates and the other the probit model. We find that entrepreneurship is higher for natives, for those who are married and for the better educated. There is also evidence that entrepreneurship increases with age and the presence of children, although this is not the case when we use grouped data.

We estimate that the differential effect of the recession on entrepreneurship in treated areas relative to control areas—β_1 in Eq. (11)—is negative and statistically

[12]The low rate might seem surprising. Notice however that unemployment in Italy is the highest among those living in the South, who are excluded from our sample.

Table 2 Difference-in-differences estimates of the differential effect of the economic recession on the probability of being an entrepreneur in IDs and OLMs

	(1) LPM	(2) Probit
Post2008.Q3*ID	–0.012** (0.005)	–0.013** (0.005)
Native	0.147*** (0.004)	0.210*** (0.008)
Children	0.009*** (0.003)	0.009*** (0.003)
Age	0.001*** (0.000)	0.001*** (0.000)
Married	0.029*** (0.003)	0.031*** (0.004)
Lower secondary	0.056*** (0.005)	0.077*** (0.006)
High school	0.103*** (0.006)	0.124*** (0.007)
University	0.218*** (0.010)	0.222*** (0.009)
N	218,998	218,998
R-squared	0.044	
ME as % of the mean	–0.052	–0.057
Mean	0.227	0.227

Linear Probability Model and Probit. Males aged 35–55

Notes: LPM is for Linear Probability Model. Marginal effects for the Probit model. ME: Marginal Effect. Robust standard errors clustered at the province level within parentheses. Columns (1)–(3) are for entrepreneurs with and without employees, and columns (4)–(6) for entrepreneurs with employees only. Columns (1), (2), (4) and (5), are based on individual data, and columns (3) and (6) on data aggregated at the local labour market level. All regressions include local labour market and period (year by quarter) dummies. *Post2008.Q3*ID*: the interaction between the dummy *Post2008.Q3* (equal to 1 after the last quarter of 2008 and to 0 otherwise) and a dummy indicating industrial district areas (*ID*). *Native*: a dummy equal to 1 for individuals born in Italy; *Children*: dummy indicating whether the individual has children; *Age*: age at the time of the interview, in years; *Married*: a dummy for marital status; *Lower secondary*: a dummy equal to 1 for individuals with lower secondary education; *High school*: dummy equal to 1 for individuals with high school or equivalent; *University*: dummy equal to 1 for individuals with college degree or higher

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

significant at conventional levels. Evaluating percent chances at the pretreatment sample mean (0.227), we estimate that the probability of being an entrepreneur after the recession is between 5.28 (0.012/0.227) and 5.73 (0.013/0.227) percent lower in the areas with industrial districts than in comparable areas. These findings point out that the share of entrepreneurs in industrial districts has suffered more than in comparable areas because of the recession.

How do we explain that entrepreneurship has declined more after the recession in areas with industrial districts than in comparable areas? The literature suggests as a candidate the higher level of production specialisation typical of industrial clusters. Glaeser et al. (1992), for instance, find that industries grow slower in places where they are over-represented. There is also some evidence that specialisation accelerates firm exit. We believe that there are two reasons to exclude specialisation as the explanation of our findings: first, we detect no difference in the level of specialisation between treated and control areas (see Table 3). Second, we redefine the common support by excluding the specialisation index from the set of covariates determining the propensity score and add as additional regressor in the linear probability specification of Eq. (1) the interaction between *Post2008.Q3* and a dummy variable equal

Table 3 Difference-in-differences estimates of the differential effect of the economic recession on the probability of being an entrepreneur in IDs and OLMs

	(1) Interaction with high specialisation areas	(2) Interaction with ID industries	(3) Interaction with declining industries	(4) Adding real exports	(5) Interaction with credit access	(6) Interaction with population density
Post2008.Q3*ID	−0.012** (0.005)	−0.015** (0.006)	−0.012** (0.005)	−0.012** (0.005)	−0.011** (0.006)	−0.012** (0.006)
Post2008.Q3* Special	−0.007 (0.006)					
Post2008.Q3* Sector A		0.006 (0.008)				
Post2008.Q3* Sector B			0.006 (0.009)			
Exports				0.091 (0.376)		
Post2008.Q3* Branches					0.0004 (0.004)	
Post2008.Q3* Credit					0.003 (0.004)	
Post2008.Q3* Pop dens						−0.000 (0.007)
N	218,998	222,933	222,933	219,072	201,143	216,180
R-squared	0.044	0.045	0.045	0.044	0.044	0.044

Linear probability models. Males aged 35–55. Each regression includes alternative confounding factors
Notes: See notes to Table 5. *Special*: a dummy equal to 1 if the index of specialisation in the local labour market is higher than the median. *Sector A*: a dummy equal to 1 if the predominant industry in the area is one that is traditionally related to industrial districts (food products, textiles and apparel, leather and related products, machinery and equipment, and furniture). *Sector B*: a dummy equal to 1 if the predominant industry in the area has had higher than the median employment and self employment losses from 2008 to 2009 (mining, utilities, wholesale and retail trade, transportation and storage, rubber and plastic products, mineral products, motor vehicles, textiles and apparel, machinery and equipment, and furniture and other house goods). *Branches*: a dummy equal to 1 for local labour markets where the presence of bank branches is higher than the median. *Exports*: real annual exports at the regional level. *Credit*: a dummy equal to 1 for local labour markets where the credit to loan ratio of the banks is higher than the median, *Pop dens*: a dummy equal to 1 if the population density in the area is higher than the median

to one for individuals living in local labour markets with a specialisation index above its median value before the recession and to zero otherwise. If specialisation was the story driving our results, we should find that the coefficient of this additional interaction is negative and statistically significant and that the coefficient associated to the variable *Post2008.Q3*ID* becomes statistically not significant. However, as shown in the first column of Table 3, our results are virtually unaffected by the introduction of the additional interaction.[13]

Alternatively, our findings could be driven by the fact that industrial districts concentrate in specific production sectors, which may have been hit especially hard by the recession. As shown above, the main sectors that characterise industrial districts are textiles and apparel, furniture and house goods, leather and related products, machinery and equipment and food products. To verify this hypothesis, we apply the same procedure used for the specialisation index, adding to the baseline regression the interaction between the recession dummy and a dummy equal to one

[13]The number of observations in Table 2, column (1) and Table 3, column (4), slightly differs because of differences in the common support identified by the propensity score.

for local labour markets where the sectors above have an important share of total employment and to zero otherwise. Again, our results are qualitatively unchanged (Table 3, column 2), although the relevant coefficient becomes larger in absolute value.

Using employment data for the period 2008–2009, we also select the sectors that experienced declines in employment higher than the median. These are mining, utilities, retail and wholesale trade, transportation equipment, rubber and plastic products, textiles and apparel, furniture and house goods and machinery and equipment. We interact the recession dummy with a dummy equal to one for local labour markets where these sectors are important and to zero otherwise. As reported in column (3) of Table 3, adding this interaction does not alter the estimated "difference-in-differences" effect.

The differential effect of the recession in areas with industrial districts could also be driven by the fact that firms in these areas have a higher propensity to export than firms in other areas and therefore have been more exposed to the contraction of international demand. To illustrate, consider the four regions where industrial districts are more widespread (Lombardy, Veneto, Tuscany and Marche) and the four regions where they are less present (Liguria, Trentino, Umbria and Lazio). If we compare real GDP growth between 2007 (before the recession) and 2009 (after the recession) in the two groups of regions, we find that real GDP in manufacturing declined by 17.8% in the former group and by 19.1% in the latter group. Services were less affected, with a decline equal to 5.0 and 6.1%, respectively. These differences are small when compared with the performance of real exports, which plummeted during the same period by 20.1% in the regions where industrial districts prevail and by 9.0% in the other regions. We verify whether our findings are driven by different propensities to export by including real regional exports in our regression. If our results were driven by exports, this inclusion should affect in a significant way the estimate of β_1. Yet column (4) in Table 3 shows that this is not the case.[14]

Following Guiso et al. (2004a), our results could also be driven by differences in the access to credit across local labour markets rather than by the presence of industrial districts. To address this possibility, we collect two measures of credit accessibility for the pretreatment period: (a) the number of bank branches per thousand inhabitants and (b) the loan—deposit ratio.[15] For each variable we construct a dummy variable equal to one for values above the median and to zero otherwise and interact these dummies with the recession dummy *Post2008.3* in Eq. (1). If access to credit was driving the uncovered differences, we should find that adding these interactions significantly reduces or even eliminates the differential effect associated to the presence of industrial districts. However, as shown in

[14]As in the previous experiments, as a preliminary step, we redefine the common support by excluding exports from the vector of covariates defining the propensity score. We have also experimented with real 2007 exports per local inhabitant rather than log real exports, with no qualitative change. Results are available from the authors upon request.

[15]Measures (a) and (b) are calculated for the time interval of 2004–2005 on the basis of municipal data (source: Banca d'Italia) aggregated at the local labour market level.

Table 3, column (5), this addition leaves our estimates broadly unaffected. We therefore rule out this explanation.

Lastly, we investigate whether our estimated effects are due to differences in population density by proceeding as in the previous cases. First, we redo our sample selection by excluding density from the probit equation defining the propensity score. Second, we add to Eq. (1) the interaction between the recession dummy *Post2008.Q3* and a dummy equal to one for the local labour markets where population density before the treatment was above the median and to zero otherwise. As shown in Table 3, column (6), adding this interaction has virtually no effect on our estimates of coefficient β_1. Thus, differences in population density do not explain our results.

A key difference between population density and industrial clusters as measures of local agglomeration is that the second emphasizes production similarity as well as proximity. As remarked by Guiso and Schivardi (2007), industrial districts are characterised by a high concentration of similar, supposedly connected firms, where social interaction is particularly intense. Both production similarity and stronger social ties facilitate information flows between network members and accelerate learning. Intense interaction gives rise to amplified responses to shocks, because "...the initial impulse is magnified by the response of the other members of the reference group" (Guiso and Schivardi 2007, p. 70). In their own study of Italian industrial districts, the authors find that firms in these areas "...should display a lower sensitivity to aggregate shocks in non-adjustment years and a higher sensitivity in adjustment years, because those should be the years in which the response to shocks is amplified by information flows..." (p. 88). Our results are consistent with Guiso and Schivardi (2007), inasmuch as we interpret the years after the 2008 recession as adjustment years.

In the thick labour markets that characterise industrial districts, the amplified response of entrepreneurs to negative economic shocks may also affect private employment as well as the transitions from entrepreneurship to employment, for instance because entrepreneurs closing their business in these areas find more easily a new job—as employees—in another firm in the same manufacturing industry, that demands the same industry—specific skills and is part of a common web of interpersonal relationships. The relevant literature defines this as a typical labour pooling effect, understood as the fact that thick labour markets facilitate the flow of workers across firms.[16]

We explore this possibility in two ways: first, we look at the effect of the economic recession on private sector employment in industrial districts and in OLM areas and second, we look at average year-to-year transitions from entrepreneurship to employment in IDs and OLMs. Table 4 presents our estimates of Eq. (1) when the dependent variable is private employment, showing that the estimated value of β_1 is positive and

[16]Labour pooling as a feature of Italian industrial districts has been investigated by D'Addario, 2011, who finds that living in an ID area increases the probability of finding a job, and by Andini et al. (2012), who conclude that the two concepts are broadly unrelated.

Table 4 Difference-in-differences estimates of the differential effect of the economic recession on employment and inactivity in IDs and OLMs

	(1) Employed	(2) Inactive
Post2008.Q3*ID	0.012* (0.007)	0.003 (0.003)
Native	−0.087*** (0.007)	−0.055*** (0.005)
Children	−0.011** (0.005)	0.004 (0.003)
Age	−0.006*** (0.000)	0.005*** (0.000)
Married	0.073*** (0.005)	−0.104*** (0.004)
Lower secondary	0.022*** (0.008)	−0.080*** (0.006)
High school	0.029*** (0.008)	−0.116*** (0.006)
University	−0.079*** (0.010)	−0.117*** (0.006)
N	218,998	218,998
R-squared	0.029	0.059

Linear probability models. Males aged 35–55

Table 5 Average annual inflow and outflow rates between entrepreneurship and employment within the same industrial sector and between sectors

Industrial Districts	Pre-crisis	Crisis
Entrepreneurship to employment—same sector	0.65	1.29
Entrepreneurship to employment—different sectors	0.61	0.66
Employment to entrepreneurship—same sector	0.87	0.48
Employment to entrepreneurship—different sectors	0.56	0.45
Other comparable areas		
Entrepreneurship to employment—same sector	0.71	0.36
Entrepreneurship to employment—different sectors	0.90	0.45
Employment to entrepreneurship—same sector	0.81	0.48
Employment to entrepreneurship—different sectors	0.24	0.28

Entrepreneurs with and without employees. Percent values

Notes: Our computations based on micro data from the Italian Labour Force Survey, quarterly data, years 2006–2011

statistically significant at the 10% level of confidence—see column (1).[17] Table 5 presents instead the year-to-year inflow and outflow rates into and from entrepreneurship.[18] On the one hand, we find that inflow rates from employment into entrepreneurship have declined both in industrial districts and in other areas, with a sharper effect in the former (from 1.42 to 0.93%) than in the latter (from 1.05 to 0.76%).[19] On the other hand, the outflow rates from entrepreneurship into

[17]The estimated differential effect for the inactive (column (2) of the table) is very small and imprecisely estimated.

[18]These rates are computed by dividing the flows by the state variable in the previous year.

[19]Similar qualitative patterns emerge for inflows from out of the labour force to entrepreneurship.

employment have increased in areas with industrial districts (from 1.26 to 1.96%) and decreased in other OLM areas (from 1.61 to 0.80%). This is consistent with the positive differential effect of the recession on employment in industrial districts.

We also find that in industrial districts, the increase in the flows from entrepreneurship to employment after the crisis is driven mainly by flows within the same industrial sector (from 0.65 to 1.29%), contrary to other areas, where these flows have declined (from 0.71 to 0.36%), suggesting that the agglomeration of firms in a dominant manufacturing industry—a typical feature of industrial districts—creates a pooled market for specialised workers and entrepreneurs with industry, specific skills, which facilitates mobility within the same industry.[20]

6 Conclusions

We have investigated whether the presence of industrial districts—a source of local agglomeration effects—affects the response of local entrepreneurship to an economic recession. We compare the probability of being an entrepreneur before and after the 2008 recession in areas where industrial districts are present and in comparable areas, using a difference-in-differences approach. To do so we use cross-sectional individual data from the Italian Labour Force Survey (ISTAT). We find that entrepreneurship has suffered more after the recession in industrial districts than in other labour markets, especially among more experienced individuals. We have empirically explored several mechanisms that can explain this differential effect, including industrial specialisation and composition, the sector of production, differences in the level of exports, credit accessibility and the composition of talents. Our results suggest that none of these channels can credibly account for our findings.

We have argued that the *social multiplier* could partly explain our results. This effect suggests that if the industrial districts are characterised by intense social interaction as previous literature suggests, the effects of a shock can be amplified by those closely connected economies, in particular by accelerating information flows. Since the multiplier operates also in the presence of positive aggregate shocks, this leads us to speculate that the positive response of entrepreneurs to an economic expansion might be stronger in areas where industrial districts prevail. Some descriptive evidence also suggests that industrial districts are characterised by a higher flow from entrepreneurship to employment that may also smooth the negative impact on the local economy. Further analysis is though required to shed more evidence on this point.

Further analysis would be also required to assess whether the same findings extend also to other types of agglomerations, as cities. Moreover, the length of our data set does not allow to analyse whether the effects of the 2008 recession are temporary or permanent. Furthermore, our analysis relies on individual level data

[20]See De Blasio and Di Addario (2005).

and focuses on labour market shocks. To shed more light on how industrial districts respond to recessions may require to explore how firms revenues and costs varies over the business cycle.

We plan to pursue some of these questions in our future research.

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Industrial Districts/Clusters and Smart Specialisation Policies

Fiorenza Belussi and Michaela Trippl

Abstract Industrial districts and clusters are of utmost importance for economic growth and innovation in the European Union (EU). In this chapter, we analyse how smart specialisation policies have worked in different region types, combining cluster policies with smart specialisation ideas. Our *study* selects a sample of EU regions that differs strongly in terms of geography, size, socioeconomic dynamics, innovation capacities, and governance settings. Two key components of the strategy development phase deserved particular attention, that is, stakeholder inclusion and policy prioritisation. The cases selected are grouped into three main region types: advanced, intermediate, and less-developed regions. The empirical results suggest that advanced regions are in the best position to develop inclusive governance forms and to benefit from smart specialisation strategies. Intermediate regions also perform quite well with respect to the development of smart specialisation strategies, coping with stakeholder involvement, planning capabilities, and the capacity to prioritise a set of clusters and sectors. In contrast, in less-developed regions, weak innovation systems, insufficient experience with regionalised innovation policies, and high levels of state centralisation have undermined smart specialisation processes.

Keywords Cluster industrial policies · Path dependent growth · New path creation · Smart policies · Industrial districts · Clusters

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1 Introduction

The literature on clusters and industrial districts[1] has grown at an unprecedented pace in the last two decades. Although the origin of the notion of industrial district is relatively old and can be attributed to the important work of Marshall (1920), the term 'cluster' was introduced by Porter (1990, 1998) in the 1990s to characterise the emergence in space (clustering) of specific types of specialised agglomerations, where specialised firms and institutions coevolve and interact (Belussi 1996).

A better general theoretical understanding of the elements representing the constituency of the 'model' has been developed by numerous contributions at the intersection between economic geography and management studies (Becattini 1990; Saxenian 1994; Pouder and St. Johon 1996; Asheim 1996; Markusen 1996; Gordon and McCann 2000; Belussi 2006; Maskell and Kebir 2006; Asheim et al. 2011a, b; Bathelt et al. 2012; Bathelt and Henn 2014; Belussi 2000; Brenner 2004; Boschma and Ter Wal 2007; De Marchi et al. 2017, 2018; Engel 2015; Hervas Oliver et al. 2008; Martin and Sunley 2003; Molina-Morales 2001, 2002).

Numerous authors have also focused on the granularity of the concept by addressing various aspects of industrial districts and clusters and investigating the growth factors linked to the elements that form this specific pattern of local development[2] (Becattini et al. 2009): (a) the presence of external economies or externalities (Breschi and Lissoni 2001), (b) the process of knowledge creation and diffusion (Belussi and Gottardi 2000; Belussi and Pilotti 2002), (c) new firm entry and start-ups (Baptista and Swann 1998; Stuart and Sorenson 2003; Feldman and Braunerhjelm 2006), (d) learning and capability formation (Amin and Wilkinson 1999), (e) labour market specialisation and the transmission of skills (Sorenson and Audia 2000), and (f) the emergence of specialised indigenous suppliers (Hervas-Oliver et al. 2017).

Another important issue concerns the evolution of clusters over time. Belussi and Sedita (2009) adopted the perspective of multiple path dependencies, based on an

[1]In this chapter we will consider the notion of industrial district as a synonymous of cluster. For a discussion of the differences and similarities, see Belussi (1996, 2015). It is clearly of foremost importance to distinguish between process of agglomeration (territorial concentration), clustering (specialised concentration interfirm linkages), and "distrectualisation" (historical specialised concentration showing social embeddedness). An analogous discussion has been presented also in Gordon and McCann (2000), where they classify agglomeration, clusters (localised interfirm transactions), and industrial districts (Italianate model of social integration). However, while in the first case local systems can evolve from one type to another (cluster ↔ district; district ↔ cluster), in the second case, we assume an "immanent", "static", and "unchangeable" typology based on social embeddedness characterises only the industrial district model (the Italianate model). In fact, what could be interesting to observe in the future is exactly the changing degree of cooperation, social benevolence, trust, and mutual support that is occurring within clusters and industrial districts in various cultural and economic contexts. This has clearly something to do with the evolution of industrial districts and clusters, path dependency, and look-in (Bergman 2007; Hassink 2010).

[2]Several works have tried to develop comprehensive typologies of clusters/industrial districts (see, for instance, Markusen 1996; Belussi and Pilotti 2002; Paniccia 2002; Wolman and Hincapie 2010).

empirical analysis of Italian cases. The authors emphasise that although clusters may have some commonalities with regard to the factors that underpin their emergence and takeoff, they subsequently give rise to a variety of developments, depending on knowledge variety, innovation intensity, local firm leadership, and external conditions. Other theoretical contributions (Martin and Sunley 2011; Ter Wal and Boschma 2011)[3] have suggested the existence of more deterministic cluster trajectories (allowing only a possible adoption) across different stages over time (with time as an irreversible factor), such as emergence, growth, maturity, decline, and renewal (for a review see Bergman 2007). Thus, cluster specialisation leads to higher synergies among firms, but too much similarity results in the so-called cluster paradox: the risks of decreasing returns, uniformity, diminished innovativeness, and in the end, lock-in (Martin and Sunley 2006; Menzel and Fornahl 2010; Audretsch and Feldman 1996).

A broad distinction can be made between industry-driven explanations of cluster growth (Ter Wal and Boschma 2011) and place-based explanations.

The former maintain that the emergence of clusters derives from knowledge discontinuity and the introduction of breakthrough innovations. During the first stage of experimentation, when knowledge is minimally codified but grows in a cumulative way, agent proximity and spinoffs create favourable business conditions. Thus, one can observe high levels of industry concentration in clusters. In the maturity phase, other firms are created at a global scale in dispersed places, and clusters lose their shape. This picture is clearly significant in the case of high-tech sectors (Menzel and Fornahl 2010).

Place-based explanations, on the other hand, reflect a cluster-specific view and suggest that clusters can grow or decline independently of the development of the industry, for reasons such as the homogeneity or heterogeneity of competencies, cluster-specific technological lock-in, and institutional or external factors (Belussi and Sedita 2009; Trippl et al. 2015a, b). Brenner and Schlump (2011) observed that the transition between stages may be a remarkably slow process. Moreover, the idea of predetermined stages of development has also been questioned (Belussi and Caloffi 2018); some clusters decline before reaching the stage of maturity or never follow a high-growth path, as observed in some Turkish footwear clusters in Konya and Izmir (Belussi and Caloffi 2018). Other clusters operating in the same sector but located in other countries, such as Italy, reached their maturity in the 1980s but have been able to stay at the technological frontier of their sector for a long time (see the case of Montebelluna, described in Belussi 2010). Many regions host clusters (but not necessarily industrial districts, which represent a specific form of clustering) but not all clusters produce high growth. Indeed, if a region has a cluster consisting of industries the demand for whose products is low and/or declining or whose production processes rely on low-skilled labour or an overly expensive labour force, the contribution to regional economic growth is likely to be small, regardless of what other

[3]A similar approach can be found in Maskell and Kebir (2006), where all phases of development to describe specific cluster life cycle stages are compressed under the headline of "existence", "extension" and "exhaustion".

institutions or specific policies are directed to supporting the cluster. Historically, after an initial period of growth, many clusters and industrial districts decline rapidly (Belussi and Sedita 2009; Belussi and Caldari 2011).

Tappi (2005) showed how complex the process of cluster evolution can be. The author described the development of a cluster that shifted from the production of musical instruments to that of ICT components by slowly absorbing microelectronic technologies. Clusters can disappear and then re-emerge, exploiting favourable market conditions, historically accumulated technological capabilities, and specialised institutions (for the case of Swiss watches, see Glasmeier 1991).

A paradigmatic case of a cluster that has not undergone decline is of course Silicon Valley, which has moved its specialisation from computers to ICT components and to social network platforms such as Google and Facebook (Saxenian 1994; Weil 2012).

Thus, transition does not necessarily imply crisis. Historical accidents certainly play an influential role in the location of some clusters. The Danish mobile communication cluster emerged recently and has already adjusted numerous times during its relatively young life, a process accelerated by the profoundly rapid pace of innovation in mobile technologies. Dalum et al. (2005, p. 231) highlighted the role played by disruptive technologies in the creation of sequential disruptions in the cluster life cycle. An accelerated scenario of early entrants, enabling institutions and universities, buyouts, mergers, takeovers, and exits, reflects the highly unstable state of the cluster in North Jutland, which successfully shifted in mobile telephone technologies from NMT to GSM to UMTS but which recently entered a serious crisis when WLAN technologies were developed by large Silicon Valley firms (Østergaard and Park 2015).

Important actors in the development of clusters are nowadays leading firms or the investment of MNEs, scientific institutions that 'feed' local firms with scientific and technological knowledge, and the creativity of local entrepreneurs. The openness of clusters and industrial districts for FDI inflows and outflows, global supply chains, and the building of external linkages appears to be a necessary (Trippl et al. 2015a, b) but insufficient condition for successful cluster consolidation and resilience (Becattini and Rullani 1996; Bair and Gereffi 2001; Dicken 2003; Nachum and Keeble 2003; Guerrieri and Pietrobelli 2004; Wolfe and Gertler 2004; Nadvi and Halder 2005; De Propris and Driffield 2006; Zucchella 2006; Belussi 2015; Boschma 2015). As discussed by Trippl et al. (2015b, p. 2036), there are good reasons to argue that cluster development might be affected by the configuration of regional innovations systems (RISs). For instance, RISs that are home to dynamic high-tech clusters may offer a fertile ground for the rise of new (but related) ones (Boschma and Frenken 2011). Policymakers may play an important role in supporting cluster development. However, cluster policies have suffered from the creationist myth (Borrás and Tsagdis 2008). If essential preconditions are not in place (e.g. potentials related to high technological dynamics), clusters can hardly be created. As demonstrated by Boschma (2007) and Rodriguez-Rodriguez et al. (2017), institutions typically follow cluster emergence.

The most effective policies are typically found in well-developed or mature clusters; this is less the case in emerging ones (Tödtling and Trippl 2013). Policies may be designed to increase the quality of local resources (supporting vocational training, research, and the provision of collective goods) or to overcome bottlenecks and excessively high levels of path dependency.

In fact, the development of a broad and comprehensive understanding of cluster evolution still constitutes an emerging topic in evolutionary economic geography and other related disciplines (management, innovation, technological change, etc.). Researchers have yet to develop a comprehensive theoretical framework or provide empirical evidence that can fully explain why and how clusters and industrial districts evolve and change over time.

One of the reasons for this is that most empirical work on clusters has provided a relatively static picture as opposed to a more dynamic, longitudinal one. Another possible reason lies in the complexity involved in integrating the diverse set of intellectual disciplines required for building a comprehensive theoretical framework capable of addressing all the actors and microprocesses involved in the functioning of clusters. The managerial perspective (e.g. Pouder and St. Johon 1996; Wang et al. 2014) can be useful at the *micro-/meso*-level of analysis, where it can shed light on how cluster firms' capabilities and strategies can recombine existing and new knowledge from inside and outside the territory. Hence, cluster firms are more prone to the cross-fertilisation of knowledge and technologies between different fields. This line of research has shown that although cluster firms are heterogeneous, they can sustain cluster evolution if they possess different but *complementary* competencies. However, the increase of absorptive capacity also plays a role: technologically weak clusters may absorb new knowledge by building knowledge connections to high-tech or innovative regions. European policies have supported this process by better connecting weak and strong regions in Europe, integrating them in various cooperative R&D programmes.

Another important issue relates to the globalisation processes of industrial districts and clusters and their relationships with European policies. Cluster dynamics and globalisation should be taken into account when designing new policies (Hervas-Oliver and Albors-Garrigos 2014; Wang et al. 2014; Crespo 2011). Currently, the openness of territories and their connection to global value chains call for a novel approach to local development.

The impact of globalisation on cluster evolution is occurring not only in terms of flows of exports but also in relation to a more complex interchange of inward and outward flows of goods, people, and knowledge, which often involve MNEs as crucial players in local nodes of global supply chains.

FDI by MNEs increasingly takes the form of knowledge-seeking investment, whereby MNEs attempt to augment their knowledge base by obtaining access to foreign pools of knowledge by becoming participants in various clusters simultaneously. Indeed, being co-localised where new knowledge/technologies/designs are generated is a more effective way to absorb these assets than intercountry, cross-border transferring. Clusters that have historically developed a high level of capabilities are nowadays among the preferred destinations of MNEs. In some cases, specific European policies are required in order to counterbalance the excessive power of MNEs in industrial districts and clusters, giving local firms and SMEs more ample access to strategic recourses in order to avoid the emergence of overly ‘oligopolistic’ local systems. ‘Indigenous’ or ‘homegrown’ MNEs are a novelty in the modern evolution of clusters: they were created during the 1990s or 2000s, when small firms invested strategic resources in innovation and expansion, progressively transforming themselves into MNEs (Sedita et al. 2013; Aznar-Sanchez et al. 2017). Policies can be orchestrated to better embed those firms into their contexts, to provide support for reshoring processes, and to support the creation of ancillary service sectors (knowledge-intensive business services, universities, research centres, key enabling actors, etc.).

Very importantly, in some circumstances, MNEs are the main actors responsible for giving rise to local clusters, whereas in others they enter (or emerge in) the local cluster in a subsequent phase of the life cycle (development or maturity). Those MNE-dominated clusters may be particularly fragile, and policies favouring diversification should be promoted.

2 Cluster Policies Within the Smart Specialisation Approach

Clusters are of utmost importance for economic growth and innovation. In several countries, and particularly in the European Union (EU) (OECD 1999; Borrás and Tsagdis 2008) and the United States (Wolman and Hincapie 2010), they have attracted the attention of policymakers. The imperative of triggering the competitiveness of clusters and industrial districts was acknowledged by the EU’s Horizon 2020 (European Commission 2012, 2014a), which emphasised the importance of clusters and the appropriateness of supporting polices articulated at different levels: European, national, and regional.

In recent years, clusters and industrial districts have become an important element in the European agenda’s shift towards the challenge of applying smart specialisation policies.

Smart specialisation strategies (Foray 2014a, b) have become a powerful concept, used by the European Commission as a condition for attracting EU funding assistance. They reflect a move from a ‘redistributive’ towards a ‘developmental’ logic, advocating innovation-based endogenous development and regional growth-oriented policies (Capello and Kroll 2016; Cooke 2004; Asheim et al. 2011b; Tödtling and Trippl 2013; Coenen et al. 2016).

However, smart specialisation strategies have been criticised, in particular for their limited applicability to less-developed regions. Like Torre and Wallet (2013), Kroll (2015, p. 2083) noted that many regional entities ‘do not possess the necessary human and material resources to adequately deal with a strategy process of the required complexity. Even where those are formally available, many administrators have been trained at pains to process and allocate European funding as such, but have no sufficient professional background in designing and running a strategy process’. Rodríguez-Pose and Di Cataldo’s (2015) work on the relationship between regional government institutions and innovation performance showed that ineffective and corrupt governments have a negative influence on the innovation capacity of peripheral areas in the EU and undermine the potential benefits of policy measures aimed at enhancing innovation.

Recent large-scale survey results (Kroll 2015; McCann and Ortega-Argilés 2016) have provided only a rather general picture, based mainly on the perceptions and experiences of local policymakers. There is a knowledge gap regarding the application of smart specialisation in the ample context of EU regions and regarding its influence on local institutions, agents, entrepreneurs, and RISs.

Smart specialisation not only represents a new strategic orientation of innovation policy (i.e. the modernisation and diversification of regional economies—see Boschma and Frenken 2011) but also tries to avoid some of the crucial failures and pitfalls of policy approaches adopted in the past (Cooke 2004; Morgan 2016a). The concept highlights place-based and evidence-based regional innovation policies (Barca 2009) in order to move beyond outdated 'one-size-fits-all' policy approaches (Tödtling and Trippl 2005) and policy mimicking. It also advocates a broad understanding of innovation that overcomes blinkered R&D-focused views. New elements proposed by smart specialisation include the concentration of public resources on a few prioritised areas and a move from top-down towards bottom-up policies (for a discussion of novel elements, see, e.g. Trippl et al. 2016).

In the past, regional policies have been criticised for not considering path dependency and lock-in in the analysis of RISs (Morgan 1997, 2013, 2016a, b; Cooke 2001; Moodysson et al. 2015), for their narrow focus on science and R&D inputs, ignoring non-R&D-based innovation activities (e.g. STI versus DUI policies),[4] for supporting firms instead of systems (Roelandt and den Hertog 1999), and for underappreciating multilevel governance and horizontal policy coordination (Cooke 2001; Gertler 2010). Inspired by recent literature that distinguishes among various forms of regional evolution (Foray 2014a, b; Isaksen 2015; Isaksen and Trippl 2016; Trippl et al. 2016), we propose the following typology, which distinguishes between continuous and discontinuous patterns of change (Table 1). Thus, in addition to the category of path extension, which reflects the continuation of an existing trajectory, we identify four other path types: path upgrading and renewal, path ramification (introduction of new sectors through a process of 'speciation', which is based on knowledge recombination—see Cooke 2016), new path creation (the emergence of a new specialisation based on breakthrough innovations), and new path entry of established industries. Our aim is to determine whether the application of smart specialisation has led to changes or continuity in the policy frameworks of

[4]"STI policies promote the 'science-technology-innovation' mode of generating novelty. STI policies are based on a narrow view of innovation and are typically supply-driven in nature, aiming to commercialise research results. DUI policies, in contrast, seek to foster ‚doing-using-interacting' modes of innovation. DUI policies thus embrace a broader view on innovation. They are demand-driven policy approaches that aim to promote the development of new products to specific markets, interaction along value chains with customers and suppliers, specialised labour markets, local technical cultures, and so on (see, for instance, Isaksen and Nilsson 2013)" (Trippl et al. 2016: 118).

Table 1 Types of regional industrial path development

Form of path development		Key characteristics
Change	New path creation	Rise of **entirely new** sectors deriving from breakthrough innovations
	New path entry of established industries	Setting up of an **established industry** that is **new for the region,** often based on the inflow of FDI
	Path ramification	Ramification (or 'speciation') of knowledge by existing industries into new but related ones industries
	Path upgrading and renewal	Major **change of an industrial path** into a new direction based on new incremental/radical innovations or new organisational forms
Continuity	Path extension	**Continuation of existing industrial paths** based on incremental innovation along established technological trajectories (danger of path exhaustion)

Source: Modified from Trippl et al. (2016)

different EU regions and to discuss the issues of prioritisation and stakeholder involvement.

3 Empirical Analysis

The findings reported below draw on recent work by one of the coauthors of this chapter (Trippl et al. 2016). The point of departure is the widespread adoption of smart specialisation across the EU. We analyse how smart specialisation has worked in different region types, combining cluster policies with smart specialisation ideas. Two key components of the strategy development phase deserve particular attention, that is, stakeholder inclusion and policy prioritisation. The priorities selected for policy support may reflect different types of regional (industrial) change.

This study selects a sample of 16 European regions (Table 2) that differ strongly in terms of geography, size, socioeconomic dynamics, innovation capacities, and governance settings. This provides a sound basis for examining the various types of smart specialisation approaches in different European regions.[5]

The work is based on a mixed-method approach. It combines secondary data analysis, desk-based analysis of existing policy practices, policy documentation and evaluative material, and focus-group meetings and in-depth interviews with more

[5]The key findings and comparative analysis presented below draw on comprehensive and detailed reports prepared by the SmartSpec EU project (seventh framework program, grant agreement no: 320131) which has seen the cooperation of numerous universities including one external expert: Padua University (report on Basilicata), Cardiff University (Bremen, North East Romania, Slovenia), Charles University (Great Plain Region, Lodzkie, South Moravia), University of Groningen (Flanders, Limburg), Lund University (Scania, More and Romsdal), Orkestra (Murcia, Navarre), Newcastle University (Northern Ireland, Tampere), and Claire Nauwelaers (Provence-Alpes-Cote d'Azur).

Table 2 Selected regions

Region	NUTS code	Country	Responsible partner organisation
Basilicata	NUTS 2 (IT F5)	Italy	Padua University
Bremen	NUTS 2 (DE 50)	Germany	Cardiff University
Flanders	NUTS 1 (BE 2)	Belgium	University of Groningen
Great Plain Region	NUTS 2 (HU 32)	Hungary	Charles University
Limburg	NUTS 2 (NL 42)	Netherlands	University of Groningen
Lodzkie	NUTS 2 (PL 11)	Poland	Charles University
More and Romsdal	NUTS3 (NO 053)	Norway	Lund University
Murcia	NUTS 2 (ES 62)	Spain	Orkestra
Navarre	NUTS 2 (ES 22)	Spain	Orkestra
North East Romania	NUTS 2 (RO 21)	Romania	Cardiff University
Northern Ireland	NUTS 1 (UK N0)	UK	Newcastle University
Provence-Alpes-Cote d'Azur (PACA)	NUTS 2 (FR 82)	France	Claire Nauwelaers
Scania	NUTS 3 (SE 224)	Sweden	Lund University
Slovenia	NUTS 1 (SI 0)	Slovenia	Cardiff University
South Moravia	NUTS 3 (CZ 064)	Czech Rep.	Charles University
Tampere (Pirkanmaa)	NUTS 3 (FI 197)	Finland	Newcastle University

Source: Trippl et al. (2016)

than 200 stakeholders in the 16 regions (policy actors, firms, representatives of research organisations, intermediaries, etc.).

The analysis includes three groups of regions, that is, advanced European regions, intermediate regions, and less-developed regions. The focus is on the organisational, institutional, and systemic features prevailing in the regional innovation systems of the 16 cases and the ways in which these features have affected smart specialisation practices in cluster policies. Furthermore, attention has been directed to the question if and how smart specialisation has led to regional innovation system and policy changes in the 16 regions, supporting policy learning (Moodysson et al. 2015), system building efforts, and policy reorientation.

The regions[6] included in the analysis display strong differences with respect to geography, size, economic development, socioeconomic dynamics, innovation performance (see Table 3), and governance settings. There is a wide disparity in terms of innovation capabilities (measured by the Regional Innovation Scoreboard). South Sweden (Scania) and West Finland (Tampere) are categorised as 'innovation leaders' (period 2004–2010). Vestlandet,[7] Northern Ireland, Bremen, PACA, Navarre, and West Slovenia belong to the group of 'innovation followers'. These eight regions exhibit a set of similarities, including low unemployment rates (Navarre being an exception), strong economic performance measured by GDP (Northern Ireland and Slovenia being exceptions), and strong competitiveness and institutional benefits (measured by high rankings according to the EU Regional Competitiveness Index [RCI] and the European Quality of Government Index [EQI]). Regions with weaker innovation capacities are Jihovychod (South Moravia), Basilicata, Murcia, and East Slovenia ('moderate innovators') as well as Lodzkie, Eszak-Alfold, and North East Romania ('modest innovators'). With the exception of Jihovychod and North East Romania, these regions have high unemployment rates and low GDPs. They also suffer from low levels of competitiveness and quality of government (see Table 3).

The 16 cases fall into three main region types—advanced, intermediate, and less-developed regions[8]—as follows:

- Well-developed regions: Scania, Tampere, Bremen, Limburg, Flanders (5)
- Intermediate regions: PACA, Northern Ireland, More and Romsdal, Navarre (4)

[6]It is important to note that data presented in Table 3 refer to NUTS 2 for the reason of data availability. However, in some cases, we have selected smaller areas, covering NUTS 3 regions (Scania, Pirkanmaa-Tampere, More and Romsdal, South Moravia), or larger areas, and precisely, we refer only to one case where a country as a whole was chosen, which was in past a smaller part/ region of Yugoslavia (Slovenia).

[7]More and Romsdal, which forms a subregion in Vestlandet, however, is classified as a moderate innovator.

[8]This classification is the outcome of several steps (see Trippl et al. 2016). In a first step, the regions have been divided into two large groups based on their rankings in the Regional Innovation Scoreboard 2014. A distinction was made between well-developed regions (innovation leaders and innovation followers, Scania, Tampere, Bremen, Navarre, PACA, Slovenia, Northern Ireland) and less-developed regions (moderate and modest innovators, More and Romsdal, Murcia, South Moravia, Basilicata, Lodzkie, Great Plain Region, North East Romania). However, a detailed analysis of challenges in relation to the development and implementation of S3 has revealed a need for regrouping. Slovenia has taken a national perspective on S3. The country is classified as follower in the Regional Innovation Scoreboard (2014). However, many of the S3 challenges found in Slovenia resemble those discovered in less-developed regions. More and Romsdal in Norway on the other hand is classified as moderate innovator. However, it is a wealthy region, performing well in DUI types of innovation, and it benefits from a vibrant entrepreneurship and collaboration culture. Thus, it faces very different challenges when compared to other regions that belong to the less-developed group. Navarre, Northern Ireland, and PACA are innovation followers. However, they face more severe challenges in relation to S3 than other well-developed regions. Thus, More and Romsdal, Navarre, PACA, and Northern Ireland form a separate group of regions which are more advanced than less developed ones, but their innovation systems are not as developed as of those in the well-developed regions group (Trippl et al. 2016: 120).

Table 3 Socioeconomic and innovation characteristics of the selected regions

	Area in square kilometres (2013)[a]	Population (2013) (population growth: 1990–2013; EU-average: 6.5)[a]		Regional innovation scoreboard[b]	Unemployment rate (2012) (EU-27: 10.4)[a]	GDP per inhabitant PPS (2011) (EU-28: 100)[a]	EQI[c]	RCI 2013[d]
South Sweden (Scania)	14,341.4	1,410,700	(16.2)	Leader	9.9	107	6	27
West Finland (Pirkan.)	64,762.4	1,370,384	(5.6)	Leader	8.5	105	8	66
Bremen	419.2	663,543	(−1.5)	Follower	6.7	158	39	38
Vestlandet (More and Romsdal)	49,162.9	866,239	(14.9)	Follower	2.9	142	–	–
Navarre	10,390	638,948	(23.1)	Follower	16.2	124	98	131
PACA	31,399.6	4,937,445	(16)	Follower	10.1	104	96	125
Zahodna Slovenija	8060.7	976,640	(8.7)	Follower	7.6	100	117	112
Northern Ireland	14,129.7	1,814,842	(14.4)	Follower	7.4	78	43	140
Murcia	11,313.0	1.461.983	(40.8)	Moderate	27.9	79	90	181
Jihovychod	13,990.6	1,679,857	(1.2)	Moderate	7.6	73	133	168
Basilicata	10,073.0	576,194	(−5.7)	Moderate	14.5	71	180	227
Vzhodna Slovenija	12,212.3	1,082,181	(−1.5)	Moderate	10.0	71	117	155
Lodzkie	18,219.0	2,524,651	(−6.5)	Modest	11.1	60	151	197
Eszak Alfold (Great Plain Region)	17,727.9	1,491,659	(−3.6)	Modest	13.9	43	129	231
North East Romania	36,850.0	3,294,204	(−12.9)	Modest	4.3	15	191	251

Sources: Trippl et al. (2016)
[a]Eurostat database
[b]European Commission (2014b)
[c]Annoni and Dijkstra (2013)
[d] Charron et al. (2014)

- Less-developed regions: North East Romania, Great Plain Region, Lodzkie, Basilicata, Murcia, South Moravia, Slovenia (7)

3.1 Advanced Regions

The group of advanced regions comprises five wealthy and well-performing regions in Central and Northern Europe: Scania (Sweden), Tampere (Finland), Bremen (Germany), Flanders (Belgium), and Limburg (The Netherlands).

These regions are characterised by organisationally thick and diversified RIS structures. Such structures have turned out to offer both opportunities for and challenges to *stakeholder inclusion* in smart specialisation processes. A significant (but not excessively broad) variety of industrial sectors has been selected, encompassing a critical mass of innovative small and large firms, strong universities active in research, teaching, and knowledge transfer, and a large number of intermediaries. Advanced regions have benefited from long-standing experience with regional innovation policies; they were early supporters of innovation activities. The main challenge in such a rich organisational environment has been to set up the most promising cluster policies in terms of promoting new sectors and consolidating old sectors, in turn allowing both established and emerging actors to participate in collective governance processes. Interestingly, the regions have addressed these challenges in different ways. In Scania, new collective governance bodies have been created to develop and implement the region's smart specialisation strategy. These bodies include key individuals from the public and private sector, selected on the basis of their knowledge of and interest in matters of regional development rather than on the basis of their position in particular organisations. Tampere has involved a large variety of actors in the discussion of challenges and opportunities related to regional innovation. Flanders and Bremen have adopted a mixed approach, relying on both collective governance bodies and consultation with regional stakeholders.

The regions in the advanced group have a long tradition of investing in technology-driven sectors. Starting from the traditional triple helix model, they have further included stakeholders such as public servants, citizens, and NGOs. Although some of the actions taken have been in line with smart specialisation, some limits have emerged, especially in the cases of Tampere, Limburg, and Bremen.

The existing institutional infrastructure was considered supportive for innovative collaborative activities. These regions also possess a high-quality government (see Table 2). However, in recent years, the regions under consideration have increasingly faced the challenge of facilitating new forms of innovation, such as public-sector, service, and social innovation. Smart specialisation has represented a useful tool for shifting innovation efforts towards those activities. Smart specialisation strategies have been used to avoid regional lock-in. This awareness has been acute not only in Tampere, where the decline of Nokia called for diversification into new areas of the knowledge economy, but also in Flanders and Bremen, both of which host traditional industries suffering from competitive pressure from emerging countries. Due to the diversity of aims perceived by local actors, some conflicts have emerged for the distribution of public resources; in Bremen, for instance, conflicts have developed between creative and ICT clusters dominated by SMEs and aerospace and logistics clusters dominated by large companies.

All advanced regions included in the analysis have benefited from a well-developed knowledge infrastructure (Tampere, Limburg) and sophisticated cluster policies (Scania, Bremen, Flanders, Tampere). In recent years, cross-sectoral platform approaches have emerged (Tampere, Scania, Bremen). For example, Bremen recognises the importance of cross-sectoral thinking, implementing its policies in collaboration with several cluster organisations in an effort to establish a synergic integration of the cluster structures. Triple helix thinking still prevails in Tampere, without a broader understanding among policymakers of the role of potential users and social innovations. Flanders has introduced a rather major shift in its innovation policy. This has led to a stronger alignment with smart specialisation guidelines. However, due to these changes, actors located in the region now perceive the policy context as highly uncertain.

Advanced regions have been found to be capable of building a very complex system for governing innovation. This has manifested itself in the distribution of responsibilities among many different stakeholders within the region (Scania), across multiple spatial scales (Tampere), or both (Limburg, Flanders). This has facilitated the successful implementation of smart specialisation strategies.

Regarding prioritisation challenges, it is important to note that all advanced regions have managed to develop evidence-based strategies, according to which they have envisaged and identified their future areas of strength. Because these regions are characterised by industrial diversity, the main policy challenge is to find the right balance between the inclusive breadth of the old areas of strength and the future, potential areas of strength to which to allocate new resources for path creation or ramification.

Some of the prioritised areas identified were personalised healthcare (Scania and Flanders), smart sustainable cities (Scania), and industry renewal and modernisation (Tampere). This allowed for the inclusion of stakeholders with problem-solving abilities (i.e. stakeholders who were not selected merely for their political importance based on the representativeness of existing sectors). Other regions have followed a cluster policy logic, focusing on agro-food and logistics (Flanders, Bremen, Limburg) and renewable energy/offshore wind energy (Flanders, Bremen).[9] Interestingly, in other cases the target of cluster policies has been the building of technological platforms with ample intersectoral applicability, such as advanced materials/smart materials (Limburg, Scania).

[9] In Bremen the establishment of the offshore wind industry cluster emerged out of the decline of the shipbuilding industry. It benefited from infrastructure in Bremerhaven and proximity to the North Sea. It started to grow faster in the last 5–7 years, though the project is already 12 years old. The regional government is currently investing €180 M in the Offshore Terminal Bremerhaven (dedicated to heavy load, assembly and transhipment facility for the offshore wind energy industry), to be completed by 2016.

The investigated regions have developed smart specialisation strategies aiming at facilitating *path upgrading* (logistics, agro-food), *path ramification* (personalised health, smart sustainable cities, aerospace), and *new path creation* (smart materials, offshore wind energy). Generally, path extension activities were not considered important aims of public policies, because incremental innovations are likely to take place without any policy intervention. Only Flanders has focused more on *path extension* and consolidation, doing so in order to further exploit renewable energies.[10] Flanders is the only region that has exhibited a clear funding commitment.[11] Despite widespread funding cuts, the region has explicitly protected funds for innovation.

In Scania and Limburg, the regional government has possessed quite limited financial resources for boosting innovation, but interestingly, in Scania there are about 100 private innovation centres/organisations that support innovation processes. In Finland, the implementation of smart specialisation has taken place via INKA programmes designed at both the local and national level. However, actors in these regions are rather experienced in attracting both EU and national funds. A large number of other challenges were identified. Tampere, for instance, has not developed enough knowledge exploitation capabilities to place the prioritised area of regenerative medicine at the centre of its innovation policy. Abrupt changes in policymaking in Flanders have compromised the trust in the policy system, with potential negative effects for the engagement of stakeholders in the implementation of the smart specialisation strategy.[12]

In Bremen, the current flagship projects are performed at EcoMat, a research centre specialising in advanced materials and promoted by the regional development agency (WFB). The initial idea for EcoMat was developed by Airbus, which wanted to create a platform with which to bring together its engineers working in advanced materials. The WFB built a cooperative space with the Airbus platform, with researchers from the Fraunhofer Institute, which specialises in advanced materials and was already located in Bremen and with researchers from other research institutes in Germany. After a while, Mercedes also joined. As a result, a large research centre (employing at least 500 scientists) will open in 2017. The analysis shows that in Bremen, large firms are more active in smart specialisation than are

[10]At present funding for three clusters has been announced, namely, materials, sustainable chemistry, and agro-food, although other clusters could be added in areas such as health and life sciences, logistics, and renewable energy systems. Each cluster will receive €500,000 per annum to come from public funds and €500,000 per annum to come from the private sector. They will be involved in a ‘cluster pact’ which is to be defined by the major firms and strategic partners involved in each cluster, such as higher education institutions.

[11]Seven clusters are mentioned in the smart specialisation strategy: ‘sustainable chemistry’, ‘specialised manufacturing solutions’, personalised cure and care, value-added logistics, specialised agro-food, integrated building-environment-energy cluster, and new ICT platforms.

[12]The South Netherlands region has identified three international top clusters which are already world-leading: agro-food and horticulture, high-tech systems and materials, and chemicals and materials. New clusters have been identified with international potential: life sciences and healthcare, bio-based activities, logistics, and maintenance.

SMEs, which have exhibited a more reluctant attitude towards collaborating with academia and the regional government.

3.2 Intermediate Regions

The intermediate regions covered by our analysis are Northern Ireland (UK), Navarre (Spain), PACA, Provence-Alpes-Còte d'Azur (France), and More and Romsdal (Norway). They have relatively advanced innovation systems, but they also display a wide variety of strengths and weaknesses in several dimensions, most notably in terms of research capability, organisational structures and institutions, and policymaking practices. More and Romsdal has lacked the presence of strong research organisations conducting basic research. In Northern Ireland, Navarre, and PACA, the innovation capabilities of the private sector have been rather limited. Despite a positive trend in the area of Industry–Academia Collaboration, there have been few innovation-oriented projects involving R&D cooperative agreements in Navarre, Northern Ireland, and PACA (this is less evident in More and Romsdal).

The regional government in Navarre has been a powerful player in the region due to budgetary autonomy. Northern Ireland has enjoyed a certain level of autonomy in the development of its regional innovation strategy, which has shifted from allocation of R&D grants to individual firms to the promotion of R&D networking among firms. There are a large number of departments and numerous support programmes that seek to promote innovation in the region.

PACA has operated under conditions of limited regional autonomy, even if in the last decade, the responsibility for managing ERDF and (parts of) ESF funds has been transferred from the national to the regional level. Because the public university system is stronger than the private one when it comes to performing R&D, the region has focused mainly on STI types of innovation policies.

Due to reforms, in More and Romsdal, the competencies of regional authorities for research and development have been strengthened in the past few years. However, the funding of innovation strategies is still related to a complex multilevel governance system.

Generally, all regions belonging to this group have shown open governance practices, enabling the inclusion of a large number of important actors in smart specialisation. Navarre, Northern Ireland, and PACA have established new bodies with representatives from different organisational fields in order to institutionalise such collaborative efforts, whereas More and Romsdal has continued to rely on well-established informal modes of including stakeholders. Northern Ireland has succeeded in involving and giving voice to SMEs. PACA has privileged private sector involvement in smart specialisation, whereas Navarre has included representatives from both the private and public sectors: SMEs, political parties and regional government, universities, and local MNEs. However, a reading of the official documents indicates a significant misalignment between regional policies and the region's smart specialisation strategy.[13]

There is also evidence that prioritisation challenges have been at the forefront in all the intermediate regions considered. These regions have implemented several interesting evidence-based smart specialisation strategies that appear to reflect their unique strengths and characteristics. In More and Romsdal, which displays a highly specialised economic structure, cluster policies have been found to have a limited cross-sectoral nature.[14] Navarre's smart specialisation strategy has lacked real prioritisation. This could be explained by the power of vested interests. In Northern Ireland, by contrast, the priority areas have been too broad, covering all major sectors of employment; only recently have regional actors begun to think more critically about identifying narrower domains. In PACA, the focus of the selected domains has been based on projects expected to have large value added and to exert a substantial impact.

Intermediate regions have tried to develop both *path extension* strategies (e.g. packaging in Northern Ireland, furniture in More and Romsdal, and health services in Navarre) and *path upgrading* strategies (e.g. sustainable tourism in Navarre, functional food in Northern Ireland, smart mobility in PACA). In some cases, they have also opted for *path ramification* strategies (e.g. mechatronics in Navarre, connected health in Northern Ireland,[15] and health and nutrition in PACA).

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[13]In Navarra several priority areas have been identified within the heading of cluster policies: healthcare economy (health services; medical appliances; biomedicine; service to persons), green economy (sustainable construction; sustainable vehicles; renewable energies; sustainable tourism; environment and waste), and talent economy (mechatronics; design and creativity; safety; business services; education). One can easily observe these regional targets which are too numerous and sometimes quite generic.

[14]The cluster programme had three specifications: the Arena programme for emerging clusters; the Norwegian Centre of Expertise projects for well-established clusters, supporting their export-oriented strategies; and the Global Centres of Expertise projects for leading clusters (selected on the evaluation of being global knowledge hubs within their sectors). *iKuben* is a cluster initiative for manufacturing firms under the umbrella of the Norwegian Arena programme. The majority of firms involved in smart specialisation are part of the maritime and the oil and gas sector; this cluster project aims to support platform technologies shared by all firms in logistics, new materials technology, and new technologies for product design. The Global Centre of Expertise *'Blue Maritime'* supports the producers of marine equipment, shipyards, ship design companies, and ocean-going fishing vessels. *Legasea* belongs to the Arena clusters and supports research activities for exploiting marine biomass and alternative uses of raw marine materials. It includes companies operating for fishing fleets, land-based processing industries, fish farms, omega-3 manufacturers, and companies that refine marine proteins. The Arena cluster *Norwegian Rooms* support firms inserted in the furniture sector, promoting new design and new material technologies, marketing, branding, supply chain management, and internationalisation. The four cluster initiatives have developed strong technological platforms to promote regional and international networking.

[15]In Northern Ireland, the selected priorities are within five areas: (1) agri-food technologies (integrated value chain, traceability, niche/functional food, packaging, and marine cliff life), (2) sustainable energy (intelligent energy systems), (3) ICT (software engineering, big data/data analytics, cyber security, capital markets, digital content), (4) advanced manufacturing/materials (advanced engineering, electronics, and electrical components), and (5) life and health sciences

A *new growth path* has been identified in Navarre (the cluster of safety, design, and creativity), in More and Romsdal (the cluster of sustainable energy), and in Northern Ireland (a cluster related to personalised medicine for degenerative diseases). Less clear, however, is how the emergence of these entirely new areas could become ingrained in regional development and thereby gives rise to flourishing clusters.

The level of collaboration within smart specialisation strategies requires close scrutiny. Navarre has suffered from a weak cooperative culture. In Navarre, prioritisation has become a very difficult task, and all the selected clusters have been poorly organised. Collaboration practices in Northern Ireland have exhibited better performance, but they are a rather new phenomenon. In More and Romsdal, the implementation of concrete actions to develop the selected priorities has encountered the difficulty of integrating SMEs, universities, and MNEs in the same project. Despite government expectations, cross-fertilisation among existing clusters has been difficult to realise. Northern Ireland has lacked a government body that could link the formulation and implementation of smart specialisation strategies. PACA has begun to move beyond its traditional STI university-focused model in order to promote a DUI strategy and able to involve in better ways than done before the private sector.

3.3 Less-Developed Regions

The group of less-developed regions covers two regions in the South of Europe (Basilicata, Italy; Murcia, Spain) as well as several regions situated in the eastern part of the EU (South Moravia, Czech Republic; Lodzkie, Poland; Great Plain Region, Hungary; Northeast Romania, Romania; as well as the whole country of Slovenia).

With the notable exception of South Moravia, innovation policies in less-developed regions have been characterised by a top-down approach, scarcity of resources dedicated to innovation projects, and limited stakeholder involvement. The evidence suggests that the introduction of smart specialisation has created a break with the old model. All regions have developed more inclusive forms of governance by mobilising several stakeholders and organising workshops, seminars, meetings, and discussion groups. However, it can be said that this radical change has not been so successful. The structural weaknesses of innovation systems in these regions have been an insurmountable obstacle.

Less-developed regions are characterised by ‘organisational thinness’, restricting the number of capable stakeholders who can offer suggestions and be mobilised for problem-solving activities in smart specialisation processes. Local SMEs are often

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(connected health and new areas in medicine). Enabling themes were leadership and cultural change, open innovation, public sector innovation, access to finance, and increase capacity and capability.

weak, and they have exhibited low innovation capabilities (North East Romania, Slovenia). When large firms exist, they are often externally controlled MNCs, having little interest in influencing regional development (Basilicata, Murcia, Great Plain Region, and South Moravia).

In some cases, the investigated regions host relatively strong universities or research institutes, but these organisations are focused mainly on teaching and basic research. Thus, they lack the 'third function' of transferring knowledge and active stimuli to local firms. As a consequence, their involvement in smart specialisation has been weak, or just formally scheduled but not activated in practice. Using all the materials collected (official reports and interviews), we observed a general failure to include local firms (Basilicata), MNCs (Murcia), or local universities (Lodzkie and Murcia) in the construction of smart specialisation strategies. In addition, the existing regional intermediate organisations are too few, too young, and have a rather limited reputation and little authority (South Moravia being an exception). In North East Romania, for example, the most important intermediate body is the Regional Development Agency (RDA), but its activity has been limited by the fact that innovation policies are centralised at the state level. RDA has produced a regional smart specialisation strategy, more as an independent exercise, without the authority of fully implementing it. The strategy has thus lacked an official status. Moreover, RDA has been underfinanced.

In all investigated regions,[16] the cooperative local culture has been only weakly developed. Mutual mistrust and opportunistic behaviour have been found to dominate. Collaborative practices have been confined to very few areas or episodes, instead of being a widespread phenomenon. The low quality of regional government, which characterises the majority of regions belonging to this group, has exacerbated the problems. In particular, too little attention has been dedicated to shifting resources towards the support of innovation activity (Lodzkie, North East Romania, Basilicata, Slovenia).

Policymaking capacities vary considerably across the regions under consideration. Murcia and South Moravia have benefited from political mandates to develop regional innovation policies, and they have long-term experience in designing evidence-based strategies. On the other side of the spectrum, highly centralised countries such as Hungary, Slovenia, and Romania have assigned limited power to regions (Great Plain Region, North East Romania). Basilicata has enjoyed a high degree of autonomy, but it has failed to craft its own strategy. The regional government has perceived the design of smart specialisation more as an administrative practice than as an opportunity to develop effective regional policies. This

[16]Some regulative institutions set at the national level also appear to have a constraining effect on stakeholder involvement in the design of smart specialisation strategies. For example, in all the regions, reward systems in academia do not favour third task-related activities, providing few incentives for university researchers to participate in smart specialisation processes. Moreover, we found the existence of country-specific regulations hindering the implementation of the smart specialisation strategy such as a complex taxation system in Poland or the requirement of legal instruments in order to create collaborative spaces, such as science parks, in Romania.

situation is similar to the one of Lodzkie, a region without any tradition of inclusive governance, which has outsourced parts of the development of its smart specialisation strategy to an external consultancy company. Moreover, Basilicata has used international experts to identify regional opportunities and challenges. The region's smart specialisation strategy has displayed some unrealistic expectations in terms of *new path creation* (e.g. biotech cluster policies)[17] and has lacked realistic actions related to *path renewal* (e.g. the sofa district). In the short run, the region also faces the challenge of renegotiating oil extraction royalties, which are scandalously low and collected mainly at the national level. Basilicata's strategy for developing a new governance body ('partenariatio'), which brings together all representatives from the research sector, the regional development agency, and the business associations, has remained a very bureaucratic attempt to establish a bottom-up governance process.

In general, some regional authorities have missed the opportunity to develop inclusive governance capabilities 'in house'. Several prioritisation challenges have been found.[18] They have selected too many areas, without any realistic feasibility to build around them a process of regional specialisation. In weak regions, policymakers appear to be overly influenced by vested interests. Smart specialisation has thus become 'the book of dreams' and not an area of informed experimentation.

In the analysed regions, many of the selected priority areas point to *path extension*, strengthening areas that are already well established in the region (such as agro-food in Murcia[19] or ICT in Lodzkie). We found also *path upgrading* (cultural tourism in Basilicata; textiles in Lodzkie via the increase of design capacities, and sustainable tourism in Slovenia). In some regions, the selected priorities reflect *path ramification*. A case in point is South Moravia, where competencies in IT and

[17] In Basilicata, the provisional priorities have included: aerospace (refers to earth observation sector), automotive, bio-economy, energy, cultural, and creative industry.

[18] This is, for instance, the case of the Great Plain Region, where current priorities in clusters/sectors selected included health industry (pharmaceuticals, medical devices, biotech, medical and health tourism, thermal water); food (functional food, innovative food, perspective food, dietary supplements); ICT (information communication technology) (innovative product development, technical information, future internet, security, enterprise management systems, big data, smart cities, e-business, software development, automation); electronics, manufacturing of machines; agriculture (crop production, manufacturing, precision agriculture); renewable energy (biomass, geothermal energy); and material sciences (electronics, photonics, nanotech, biomedical materials, solar panels, special materials, energy storage, energy product development).

[19] The smart specialisation strategy of Murcia grouped three thematic areas into agro-food (agriculture, livestock, fishery and food industry), quality of life (tourism, health, habitat), and driving forces (energy, shipbuilding, maritime, petrochemistry). The areas identified are related to the regional economic structure. However, the outcome of smart specialisation processes resembles a whole grouping of the regional economy rather than a process of prioritization. Furthermore, the areas that are identified do not have a common denominator. They include a sector-based group (agro-food), a theme group (quality of life), and a group based on its importance in the regional economy (driving forces). The focus of this strategy is blurred. The goals are very broad, and, in contrast, the problem of low education in the regional labour force remains unaddressed.

mechatronics have been brought together to develop the new cluster of medical appliances.[20] Another example is smart cities and communities in Slovenia, which would require the development of a cluster with cross-sectoral interactions.[21]

Very few priority areas selected in the regions under consideration have the potential to open up for *new path creation*, exploiting local scientific capacities of research organisations. Earth-controlling technologies in Basilicata represent a notable exception, although it remains unclear how the region could attract new firms or MNEs in order to develop a process of knowledge exploitation.

In general, the bias towards existing paths partly reflects low innovation and diversification capabilities, because university–industry links, spinoff activities, and entrepreneurial dynamism have been absent in the less-developed regions. Although these regions have faced many challenges when developing smart specialisation, it is also fair to say that the adoption of S3 has triggered learning processes that support systematic efforts to improve the regions' innovation systems. This has taken different forms. In the case of Lodzkie, smart specialisation has activated more positive attitudes among researchers (especially younger ones) towards collaboration with industry. In Basilicata and Slovenia, smart specialisation requirements have set in motion a process that might change the past top-down routines, strengthening policymakers' capabilities in the longer term. Evidence from Lodzkie[22] and the Great Plain Region suggests that stakeholder involvement has reduced mutual mistrust, which must be seen as a precondition for developing higher levels of intraregional connectivity in the future.

Many of the regional challenges discussed above tend to persist in the implementation phase of smart specialisation. Economic renewal will hardly take place without strengthening the absorptive capacity of the private sector or without fostering the integration of strong actors (MNCs, universities, research organisations) into the region. The quality of government, the adoption of a more collaborative culture, and stronger industry–university connections are of pivotal importance for the success of smart specialisation. Other challenges are more specific to particular regions. For instance, a fundamental issue is unclear funding and budgetary commitments (only Murcia provided a clear budget estimation for its smart specialisation strategy). Financial resources for the implementation of the

[20]In South Moravia the following areas have been prioritised: (1) advanced manufacturing and engineering technologies; (2) precision instruments; (3) development of software and hardware; (4) drugs, medical care, and diagnostics; and (5) and technologies for the aircraft industry.

[21]The final version of Slovenia's smart specialisation strategy was based on nine priority areas: healthy working and living environment, smart cities and communities, smart buildings and home with wood chain, natural and traditional resources for the future, networks towards circular economy, sustainable food, sustainable tourism, industry 4.0 (factories for the future), health medicine, mobility, and materials as products. Prioritisation was not indicated.

[22]In the smart specialisation strategy for the Lodzkie region, six regional specialisation areas have been selected: modern textile and fashion industry, including design; advanced building materials; medicine, pharmacy, and cosmetics; power engineering, including renewables; innovative agriculture and food processing; and IT and telecommunications.

strategy have been very limited in some of the regions (e.g. Lodzkie, Grain Plain Region, Northeast Romania[23]) or have been constrained due to economic crises (Murcia). Slovenia has suffered from political instability, leading to a lack of continuity in policymaking. In contrast, Basilicata has suffered from limited capacities to absorb and correctly utilise the received funds. In addition, Basilicata has lacked concrete implementation tools.

Finally, the analysis of less-developed regions leads to another important consideration. The implementation of smart specialisation strategies might be hindered if it is perceived primarily as a means of attracting more EU funds rather than as a tool for promoting processes of regional development.

4 Conclusions

The empirical results discussed in this chapter suggest that advanced regions have been in the best position to develop inclusive governance forms and to benefit from smart specialisation strategies. This can be understood as a result of the interplay of several factors: (a) the presence of organisational thickness, (b) firms' technological variety, (c) institutional diversity, (d) a deep-rooted culture of collaboration, (e) high quality of government, and (f) stakeholder involvement in policymaking. The engagement of regional public bodies has allowed for a better selection of thematic areas and clusters with future potentialities (as discussed also by Estensoro and Larrea 2016). At the same time, it appears to be the case that a successful adoption of smart specialisation will exert a positive impact on regional innovation systems, moving beyond the traditional triple helix pattern, where various actors experiment with new forms of innovation that include a larger variety of stakeholders. Common elements found in advanced regions are the visionary capability to focus on a small number of carefully selected actions, specific policies, cluster support, and intersectoral technological platforms with public and private actors, leading firms, research institutions, and MNEs.

Intermediate regions also performed quite well with respect to the development of smart specialisation strategies, coping with stakeholder involvement, planning capabilities, and the capacity to prioritise a set of clusters and sectors. Previous policy experiences have helped such regions select a small number of credible aims and corresponding actions. The introduction of smart specialisation appears to have advanced regional practices, in many cases facilitating the inclusion of SMEs.

In less-developed regions, weak innovation systems, insufficient experience with regionalised innovation policies, and high levels of state centralisation have

[23]However, in Northeast Romania cluster organisations are beginning to emerge, and there is the gradual development of science and technology park facilities in the main centre of Iasi. While there are very few high-technology companies, there are six active small clusters in the region in the fields of medical imaging, textiles, agro-food technologies, tourism, ICT, and new media. After prioritisation three areas were identified (agro-food, biotechnology, and clothing and textile).

undermined smart specialisation processes, as Iacobucci (2014) also argued. The core challenge relates to the question of how to apply smart specialisation under conditions of organisational, institutional, and systemic deficiencies. Although most regions in the past have developed innovation strategies, experiences of more inclusive governance structures have been largely missing. In fact, stakeholder involvement has constituted a true novelty.

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Cluster Advantage and Firm Performance: A Concluding Remark

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This book does not represent only an up-to-date analysis on the industrial districts and clusters (ID/C) theory, involving several experts coming from different academic experiences and European and non-European country origins (Spain, Chaps. 3, 6, 7, 9, 11, and 14; Italy, Chaps. 3, 5, 8, 10, 12, 13, 15, and 16; Germany, Chap. 3; the UK, Chaps. 5 and 12; Austria, Chap. 16; Poland, Chap. 4; the USA, Chap. 7); rather, it is also a tentative attempt to settle the issue of cluster through a deeper investigation focused at the micro-level, that is, taking the firm as the unit of analysis within regional/local contexts: how firms originate within ID/Cs, how they develop, and how they decline.

The main idea is to provoke an analytical shift toward the unit of analysis: not just the forest and the cluster but the individual trees, the firm, which form the forest, and the aggregated subunits of bushes, clearings, and the mix of varieties that lives in symbiosis.

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1 Clusters: A Cross-Boundary Concept

The first interesting contribution to the analysis of the cluster concept derives from a historical long-term exploration of the literature. In Chap. 8 (Caloffi, Lazzeretti and Sedita), the authors are applying the bibliographic analysis to the evolution of ID/C literature, guiding us to further study this cross-boundary concept, which confirms the trend towards management-related topics, where innovation and firm performance are the leading issues. The analysis is based on 8381 articles and 829 journals. Analysis is split into two periods (1985–1999 and 2000–2013). The group of most relevant journals in the literature, in terms of number of the articles published, were in the first period (*Strategic Management*, *Journal of Environmental Planning*, *Regional Studies*, *Academy of Management Review*, and *Research Policy*), while in the second period, we can observe *Research Policy*, *Regional Studies*, *European Planning Studies*, *Strategic Management*, and the *International Journal of Technology Management*. We see that the general boundaries of the discipline extensively involve management studies. In those years we moved from a local development approach and from sociological-related issues to management-related topics and from the field of Economics and Geography to the fields of Management and Innovation. The content analysis of the ID/C literature, divided in three periods, is moving from the concepts of (a) flexibility, location, flexible accumulation, and embeddedness to (b) knowledge spillovers, patent citations, proximity, knowledge transfer, and tacit knowledge and (c) knowledge spillovers, knowledge transfer, patent citations, structural holes, and innovation systems. The scholarly debate that characterized the 1980s was developing around the creation of a sustainable growth path based on ID/C and flexible small firm models. Product differentiation and innovation allowed the construction of post-mass production systems. During the 1990s, silicon-like ID/C brought a growing interest in the origins and dynamics of production networks. Several studies supported the new approaches toward a coevolutionary view of firms, firms' networks, social structures, and local institutions. In the period 2000–2009, literature becomes increasingly focused on innovation and knowledge spillovers, together with absorptive capacity. It was discovered that territorial proximity triggered innovation and collective learning, allowing leading innovators to develop endogenous growth paths. In this context, university-industry relations, venture capitalists, technological transfer via interactions, and clients-suppliers-subcontractors showed how ID/C may develop distinctive organizational knowledge and dynamic capabilities. The analysis referred to the literature of 2010–2013 illustrates the existing mix between firm-level and cluster-level studies, where knowledge absorption from external sources starts to become as relevant as the issue of international strategic alliances and ID/C internationalization.

2 The Effects of Being Located in Clusters: Positive and Negative Externalities Reconsidered

The goal of Chap. 2 (Fornahl, Grashof, and Söllner) is to provide an overview derived from the empirical analysis of numerous studies, about the effects of being located in clusters, comparing firms located by both inside and outside clusters. In doing so, through a meta-analysis of the literature, the following indicators were investigated: firms' innovativeness, productivity, employment growth and wage level, entrepreneurship, firms' survival probability, and the growth of start-ups.

The first element of analysis regards the connection of externalities with the cluster life cycle. Audretsch and Feldman (1996) found that geographically concentrated companies experience above-average innovation rates during the early stage of the industry. However, during the mature and declining stages, the opposite is true: in the latter stages, companies outside clusters tend to be more innovative than companies within clusters. The authors conclude that the positive agglomeration effects during early stages are replaced by congestion effects in latter stages. However, these trends showed at aggregated levels, and specifically based on the US analysis, might be covering interesting counterfactual cases. Beaudry and Breschi (2003) remind us that not just clusters are important for triggering innovation but also regions. They found that a company is more likely to innovate if it is located in a region where a large knowledge stock exists and where the concentration of innovative companies from the same industry is high.

The work of Hervas-Oliver et al. (2018a) analyzes a large dataset of 6697 companies across 23 industries in Spain. It shows that knowledge-rich companies contribute the most to agglomeration externalities but gain the least. They explain this asymmetric distribution through involuntary knowledge spillovers by the knowledge-rich firms. This is in line with the theoretical argument of adverse selection, presupposing that "good" companies have no incentive to enter a cluster (Shaver and Flyer 2000). However, historically, clusters are not formed by footloose companies optimizing continuously their localization. Rather, innovative companies are emerging spontaneously in clusters, and more and more, recently, they are said to be acquired by external MNEs. Thus, in the end, it is also reasonable to assume that innovative companies are better off when located in clusters, despite the potential knowledge spillovers.

In addition, Folta et al. (2006) highlighted the importance of the cluster size: after exceeding a specific cluster size (in their case 65 companies), the positive effect on innovation intensity diminishes due to diseconomies of agglomeration.

In general, all the articles examined proved that companies located in clusters have a higher productivity than companies outside clusters. However, they indicated an inverted U-shaped relationship with size and other factors (see Hervas-Oliver et al. 2018a): this seems to be particularly evident only for small firms.

Furthermore, in examining the vast literature produced in recent years, it is pointed out that, apart from the firm size, also the level of local connectedness is an inverted U-shaped moderator. In general, the collaboration with other companies in the same cluster/region is positive, but having a relatively high share of local connections allows reduction of the positive impact of global connections and companies may be missing external linkages, ending up in a (technological) lock-in or in an inertial state. A too high level of local connectedness reduces the efforts spent by a company in order to connect with companies outside the cluster. Employment and wages were also found to be significantly higher in firms located within clusters compared to firms outside clusters.

Lastly, clusters have rather positive effects on entrepreneurship and firms' survival, which, however, can vary depending on the industry, the innovativeness, the entrepreneurial culture, and the presence of big companies. The motivation to start a new business is higher if one is surrounded by entrepreneurial role models; by active institutions, specialized human capital, and infrastructures; and by a geographically concentrated demand of certain products and services, as Hervas-Oliver et al. (2018b) point out. In short, as Hervas-Oliver et al. state, the clusters present mostly benefit local companies in terms of gains (profits, knowledge, etc.) although asymmetrically distributed. Moreover, clusters are local ecosystems of innovation that also promote entrepreneurship mainly through spinoffs from local companies. Again, the knowledge asymmetries of local incumbent firms drive also different performance on all indicators. This an area of utmost importance to keep researching for more insights.

3 The Extensive Role of Agglomeration Beyond the Typical Phenomenon of ID/Clusters

The phenomenon of agglomeration goes beyond the typical ID/C (industrial district and cluster) model of localization. Chapters 9 and 7 (Diez-Vidal and Montoro; Peiro-Signes, Segarra-Oña, Verma and Miret-Pastor), respectively, tackle the analysis of a science park located in Madrid, in which the evolution of firms' relationships and local knowledge networks is put under scrutiny, and the study of hotel performances of a total of 27,207 US hotels, 4339 of them located in US touristic clusters. Referring to Chap. 9 and its data analyzed (which comes from interviews with 76 localized firms), it offers interesting results for the length of stay of a firm inside a park. In early stages, firms are taking important investments that can contribute both to transfer valuable knowledge among firms inside the park and to get a better understanding of the knowledge provided by others. Nevertheless, networks among firms that have spent a long period in the park seem to be less conducive to creating these local knowledge spillovers. Firms tend to be more innovative in the growth stage, when they have spent between 3 and 6 years in the park. Firms develop more products, which are new for the firm or also new for the market, while also they introduce new processes in this intermediate stage. In a similar way, firms invest more in R&D in this second stage. Comparing the incubation period (less than 3 years) with the growth period (3–6 years), we observe that firms increase in all the indicators considered. As firms consolidate their activities in the industry, they tend to invest more in new R&D investments, and they are also able to successfully commercialize their products. Nevertheless, when firms reach a maturity stage (they spend more than 6 years in the park), these variables are reduced. The results of the network analysis show that as firms spend more time in the park, they develop a higher number of direct relationships: firms begin in the park with four relationships and evolve to six in the growth period, and after 6 years they have about seven relationships. These data confirm also the preferential attachment logic: firms prefer to establish relationships with firms that have already built relationships with many others. In doing so, they can benefit from the higher status and power of those with many connections. From this research a clear recommendation for both managers and policy makers emerges: after 6 years the benefits of belonging to the science park are harder to identify.

In Chap. 7, using data over a period of 5 years from the Smith Travel Research (STR) database, the economic performance of hotels is analyzed, confronting US touristic clusters and locally dispersed, outside-cluster hotels. The aim of the research was to determine if the cluster effect is affecting the economic performance of hotels. Hotels are segmented and compared to similar groups in terms of revenue, scale, location, and affiliation, and then each of the hotels within a touristic cluster is compared to a similar group of outside-cluster hotels. Though the mean values for economic performance are higher for outside-cluster hotels, some properties located in clusters perform better. But the cluster effect is not affecting all the hotels in the same way.

The first interesting observation is to note that hotels located in clusters did not perform better in the long term during the period of economic crisis. Also, luxury hotels in clusters performed significantly better over those located outside clusters because of a larger increase in revenue.

On the other hand, mid-price to budget hotels in cluster had stronger negative results than those outside clusters. In all cases, those differences were statistically significant. Chain management or franchise hotels are not different, whether inside or outside of the cluster. In contrast, independent hotels performed significantly better if in a cluster over those independents outside clusters. Hotels located in clusters and in urban areas performed better, although the increase was higher in revenue than in demand, with the exclusion of properties located in peripheral suburban areas and airports which performed significantly worse. No significant difference emerged in the case of resort and metropolitan areas. Finally, considering concentration (LQ level), properties located in low-concentrated clusters produced better results than properties located in medium- or high-concentrated areas. The research outputs allow us to conclude that luxury and urban hotels are clearly benefitting from being located in a touristic cluster, especially if the cluster is low-concentrated. These insights reveal the asymmetric gains shown in Hervas-Oliver et al. (2017) and open up an interesting research avenue on dissecting more about those asymmetries and their drivers. Overall, the stronger negative results observed in Chap. 7 confirm what Sorenson and Audia (2000) have claimed about agglomerations: negative results exist because excessive (local) competition can overcome positive gain. As it is said, we need to learn about the net gains (Hervas-Oliver et al. 2017; Sorenson and Audia 2000; Stuart and Sorenson 2003).

4 Exploring Industrial Districts and Cluster Typologies

There are many ways of classifying ID/Cs according to the process(es) through which cluster benefits are produced. In this book we have considered the Marshallian notion of industrial district as synonymous of the Porterian notion of cluster. In Belussi (1996) and Belussi (2015), we have put forward a careful examination of the differences and similarities.

During the 1920s, Marshallian districts are characterized by the presence of traditional and low-tech sectors such as wool and cotton (see the Lancashire case discussed by Belussi and Caldari 2009); footwear or engineering industries based on artisan skills, such as Sheffield in the production of cutlery; automobile manufacturing; etc. The formation of ID/C continued also in the post-World War II in advanced countries (Belussi et al. 2003), in the same sectors which declined in Britain after the 1930s but that emerged in Italy, Spain, France, and Germany (in textile clothing, footwear, packaging, tiles production, furniture, automobile, wine industry, etc.), through the agglomeration of flexible SMEs. In the last 30 years, in contrast, many researchers have envisaged also a new phenomenon: the formation of high-tech ID/C in ICT and software (see the paradigmatic case of Silicon Valley Saxenian 1994), biotech-pharma, finance, pharmaceuticals, finance, advertising, and media sectors (Karlsson 2008; Feldman and Braunerhjelm 2007; Mudambi and Santangelo 2016; Belussi and Hervas-Oliver 2017).

There are other ways of classifying ID/C without just referring to their sectoral dominance (in manufacturing, service sectors, or agriculture). ID/C can be characterized by whether the goods and services that they produce are in fast- or slow-growing sectors nationally or internationally, or, again, by the nature of the labor force skills at their core (low-skilled or high-skilled), or by the average wages paid by local firms, or again, by their export performance (Simmie 2008). Finally, ID/C can be characterized by being located in urban or peripheral areas (Feldman and Audretsch 1999).

Another set of ID/C differences (Wolman and Hincapie 2014) may have to do with the extent to which clusters are consciously organized at local or regional level, through the creation of cluster organizations encouraged by the intervention of cluster policies (with human intervention aimed to create, build upon, or improve a cluster) or whether their functioning is just explained by pure market forces that occur naturally.

Following the Markusen's typology (1996), ID/Cs may be spontaneous (Marshallian or with activity aggregated among one or few leading firms: hub-and-spoke) or planned by government (science-based clusters located in science parks, e.g., Sophia-Antipolis) or, again, deriving from the activity of MNEs entering developing countries: satellite clusters. In fact, the Markusen typology bases its theoretical framework on the size of the firms that are part of the ID/C, their linkages and networks within and across the district, and the distribution of power among firms.

In contrast, Gordon and McCann (2000) and Iammarino and McCann (2006) have posited three basic models of cluster processes which are looking more generally to the modality of agglomeration, the sectorial specialization, the network activity among firms, and the level of social embeddedness. They distinguish between process of agglomeration (territorial concentration), clustering (specialized concentration interfirm linkages), and "districts" (historical-specialized concentration showing social embeddedness), presenting three models:

- Pure agglomeration economies
- Industrial complex
- Clusters with social networks

They classify agglomeration, clusters (localized interfirms transactions), and industrial districts (*Italianate* model of social integration) as radically different types of local systems. However, their typology is rigid and static. In our view, local systems can evolve from one type to another (cluster ↔ district; district ↔ cluster). For instance, many industrial districts located in the South of Europe, after the recourse to delocalization strategies or offshoring (Sammarra and Belussi 2006), to global supply chains (Gereffi et al. 2005; Belussi and Sammarra 2010), and having suffered from the 2007 crisis, have radically transformed their industrial structure, and we have observed diminishing cooperation, social benevolence, trust, and mutual support and a radical emergence of leading large firms, with the entry of MNEs (Belussi and Hervas-Oliver 2017; De Noni et al. 2018). This has clearly blurred the difference between the idea of industrial district and cluster. Really interesting new research avenues are going to emerge from this particular area of categorization, due to the new metamorphosis observed on how clusters and IDs evolve.

Considering this literature, Chap. 12 (Bellandi, De Propris, and Santini) offers a reflection on the endogenous rerouting and longevity of ID/Cs. In their critical review, the focus mainly on the analysis of radical knowledge creation in ID/Cs is the main element distinguishing the historical evolution of this territorialized form of development, which can be historically described through the Mark I, Mark II, and Mark III typologies. Following Belussi and Pilotti (2002), Belussi and De Propris (2013), and Bellandi and De Propris (2015), Mark I relates to a complex socioeconomic adaptive system characterized by a path accumulation localized technical knowledge and decentralized industrial creativity (Bellandi 1996). While Mark I represents the typical Marshallian district, Mark II is the result of the reemergence of ID/Cs during the 1980s in a context of flexible specialization and robust transition capacities and processes of learning by doing, using, and interacting (Asheim 2000). In Mark III ID/Cs should avoid rigid specialization traps, exhaustion of innovation thrust, and lock-in clashes with constantly increasing innovation capacity of global competitors. Exploring and exploiting new global knowledge, these clusters overcome inertia, income-seeking behaviors, and coordination problems. Knowledge, here in Mark III, is more codified and may come from gatekeepers or trans-local anchor firms (Belussi 2015).

The district effect revisited is the focus of Chap. 3 (Boix, Galleto, Sforzi), where an empirical study is presented regarding Spanish local systems and districts. The study of innovative firms is based on data regarding patents and utility models (mainly designs) registered during the period 2001–2005. Local systems are characterized as (1) industrial districts, (2) as manufacturing areas where large firms predominate, (3) as nonspecialized manufacturing areas, and (4) as large metropolitan areas. Counting on average the number of innovations per area, the most intensive innovative type of local systems turns out to be the "pure" Marshallian districts, with 446 innovations per million employees, followed by the metropolitan areas, with 427 innovations per million employees. The third position is conquered by manufacturing areas where large firms predominate with 366 innovations per million employees. Weighted patents (considering the costs of application for obtaining a patent among the different offices: national, European, and WIPO) give the predominance to large metropolitan areas (178 innovations per million employees) and then to ID, with 135 innovations per million employees, while in the third position, we find manufacturing areas where large firms predominate (127 innovation per million employees). Therefore, in relation to their findings, both considering unweighted patents and weighted patents and estimating the contribution of many innovation-related variables, the authors are able to demonstrate that industrial districts cannot be considered weak innovators.

Also Chap. 10 (Belussi and Caloffi) represents another industrial district "exercise," presenting a qualitative and quantitative analysis of the long-term development of the footwear industry in Italy and Turkey, focusing in particular on four main industrial districts/clusters (one in Italy and three in Turkey). Agglomeration benefits appear to exist in the various initial stages of the ID/C life cycle (Belussi and Sedita 2009), but not for the final phase of the main "mature" ID located in Italy: the Montebelluna cluster that now has taken the form of a multi-localized cluster in Timisoara and China, where many former small firms are now large homegrown multinationals. In Montebelluna (Belussi 2010), homegrown multinational firms established after the 1990s (Tecnica, Geox, Alpinestars, Aku, etc.). During cluster emergence, the presence of a specialized local labor market, and the formation of a district atmosphere, characterized by the circulation of ideas among entrepreneurs, was a common feature, as described by Marshall (1920). Later on, the subsequent stage of cluster development was driven by the ability of some leading firms to connect the cluster (and its internal supply chains) to external markets, to global knowledge sources, and to a global supply chain. In addition, heterogeneity predominates: not all firms show an accelerated pattern of growth after being located in the cluster. Apart from the life cycle, the four clusters differed also in terms of the economic external environment (mature vs. emerging fast-growing countries) for the existence of country-specific institutions (among which labor regulations and environmental protection), for innovation intensity (high innovative clusters vs. imitative clusters), and for the political frame (free market policies vs. defensive barriers to import policies). In the Istanbul cluster, the leading role is played by large Turkish retail chains, which are also manufacturers but which buy 40–50% of their sales from other (contractors) Turkish firms mainly located in Turkey clusters. The most dynamic Turkish leading firm is Zylan, which recently entered the Montebelluna district through greenfield investment, focused on prototype design for Turkish production. Zylan has also acquired the brand Lumberjack from Canguro (an Italian firm based in Verona that went bankrupt), together with its distribution networks. This means that globalization is now creating networks of firms among global districts, beyond the existence of global value chains.

A more theoretical chapter, written on similar theoretical research questions, is Chap. 6 (Hervas-Oliver, Manjarres-Henriquez and Boronat-Moll). How do ID/Cs evolve? Are leading firms and gatekeepers feeding the process of the introduction of new technologies in clusters and promoting original breakthrough innovations? What types of firms bring different types of innovation and knowledge?

Leading companies impose their technological trajectories on firms in their orchestrated network. Generally, in ID/C leading firms are mainly responsible for upgrading industrial districts shaping a district's learning process (Lorenzoni and Lipparini 1999), as long as knowledge upgrading is incremental, a fact that can promote lock-in in the long term but that makes ID/Cs extend their stages of growth. The authors hypothesize that new radical knowledge in ID/Cs is introduced not only by incumbent but by new firms, which rejuvenate old rigid trajectories. In doing so, the authors point out that the entrance of new firms brings new knowledge, renews the existent technological path, and favors district evolution. Therefore, disruption in ID/Cs often needs knowledge coming from outside the sector-specific technology developed in the cluster. To conclude, first, in ID/Cs, leading incumbents demonstrate predominantly an orientation toward the creation of incremental-sustaining knowledge, but they do not create important breakthroughs; second, radical disruption can be expected to be led by new firms and not by incumbents or technological gatekeepers; third, disruptive ideas must come from other industries and non-related technological fields, and they must be based on external linkages, forming in this way new technological trajectories which may renew clusters; and fourth, leading incumbents also play a role, as they act as "translators" or "facilitators" of these radical innovations (see Hervas-Oliver et al. 2018b). The authors sustain that while leading technology gatekeepers are quintessential in promoting innovation in ID/Cs, new firms are also necessary when radical innovation occurs, as those new firms bring technology not directly related to the leading incumbents or the cluster [e.g., electronics in the Jura wristwatch cluster (Glasmeier 1991), plastic injection in Montebelluna (Belussi 2010), digital printing technology in ceramics (Hervas-Oliver et al. 2018b)]. Put differently, both gatekeepers and newcomers foster complementary radical innovations, due to the social ties controlled by local gatekeepers (and not hold by newcomers). Clearly, this theoretical approach deserves further elaborations with the support of empirical evidence and helps us to design new lines of future research.

An important feature of modern ID/Cs is the role played by MNEs when they enter clusters and coevolve during time. This issue is at the center of interest of Chap. 5 (Barzotto and Mariotti). The chapter investigates whether, within the industrial districts, the labor workforce skill composition of foreign multinational enterprises'

(MNEs) affiliates differ from those of local firms. The analysis uses microdata of the Veneto NUTS2 region (Northeast Italy), which represents an economic area world-renowned for its manufacturing production organized around several industrial districts. Data refer to 28 industrial district areas (mainly specialized in machinery and equipment, wood and furniture, jewelry, textile and clothing, and leather and footwear), as calculated by the Italian statistical office for the 2011 9° Census (ISTAT 2015), which corresponds to a total working population included in those areas of 1,278,439 labor units, equivalent to 26.2% of Italian employment present in areas characterized by industrial districts. According to REPRINT,[1] 257 MNEs invested in Veneto with 299 manufacturing affiliates, which represent 11% of the total foreign affiliates in Italy.

This empirical research, has matched three important different sources, AIDA, REPRINT, and SILV (Informative System Veneto Labour) database by Veneto Lavoro. Statistical analyses refer to a representative sample of FDI investments in which data on individual workers are compared with those of local firms, of similar size and sector, showing that foreign affiliates of MNEs located in the Veneto industrial districts hire more skilled workers, more experienced workers (above 30 years old), as well as less foreign workers. This work provides evidence on the positive impact of the presence of foreign affiliates of MNEs on the sustainability of the ID socioeconomic fabric.

5 Coping with Economic Crisis

The effect of economic recessions on entrepreneurship is, in principle, ambiguous. By reducing income and wealth, they can lower the incentive to start or stay in business. At the same time, recessions shrink employment opportunities, and this could induce people to shift to self-employment as an alternative to inactivity and unemployment. Do these effects vary with the presence of agglomeration economies? Our book includes three chapters (Chaps. 13, 14, and 15) that authoritatively try to respond to this intriguing issue.

Chapter 15 (Brunello and Langella) runs an empirical investigation, matching cross-section microdata from Northern and Central Italy, where industrial districts are particularly widespread, with local labor market indicators. Using micro-level data from the Italian Labour Force Survey from 2006 to 2011, the authors adopted a "difference-in-differences" setting (DiD) that compares the evolution of the share of entrepreneurs before and after the 2008 recession in industrial districts (ID) and in the rest of the economy.

The chapter's focus is on the bulk of Italian entrepreneurship, that is to say men aged 35–55 working in the Northern and Central areas of Italy. We find that the share of entrepreneurs has declined more after the 2008 recession in areas with industrial

[1] Italian Database

districts than in the rest of the economy. Depending on the estimation method, and measured in terms of the pretreatment average share, the estimated differential effect is between 5.3 and 5.7% (in absolute value).

A "social" multiplier effect (Guiso and Schivardi 2007) is discovered that shows that agents facing an uncertain environment take decisions imitating nearby actors, starting a self-reinforcing process that prompts many agents to undertake the adjustment within a short time span. The idea is that the intense social interactions typical of industrial districts facilitate information flows, thereby amplifying the effects of a shock in closely connected economies.

After the crisis, in industrial districts, an increase in flows from entrepreneurship to employment, within the same industrial sector, can be observed, suggesting that agglomeration, in contrast to what happened in other areas, creates a pooled market for specialized workers which facilitates mobility within the same industry. Thus, during crises, ID/Cs may perform worse, but the multiplier effect could also exert its influence in recovering times, where ID/Cs could amplify their growth.

Studying the impact of natural disasters on economic growth, Chap. 13 (Cainelli, Frascasso and Vittucci) has developed a firm-level analysis to test whether the location of a firm within an industrial district mitigates or exacerbates the impact of a disaster on the firm's activity and performance. The Italian region of Emilia-Romagna was chosen as a natural experiment exercise, because it was affected by a sequence of earthquakes in 2012. This study addresses the question of whether the location of a firm within an industrial district mitigated or exacerbated the impact of a local natural disaster. The empirical analysis is conducted on a sample of about 26,000 manufacturing and KIBS firms located in Emilia-Romagna (a region in the Northeast of Italy) in the period 2010–2013. Using econometric methods it was found that the earthquake reduces turnover, production, value added, and return on sales of the surviving firms, at least in the short term. In addition, the debt over sales ratio grows significantly more in the firms located in the areas affected by the earthquake. But the research shows that the negative impact of the earthquake is slightly higher for the firms located in industrial districts than for those outside such areas, thereby suggesting that, at least in the short term, the usually positive cumulative processes associated with location within an agglomerated area may reverse and magnify the negative impact of a disruptive exogenous supply shock.

A similar research frame is developed in Chap. 14 (Gonzalez-Bravo, Lopez, and Valdaliso), where it is analyzed whether belonging to an entrepreneurial affiliation connected to a cluster in a Spanish Region (the Basque Country) could "shield" from adverse economic scenarios and promote a better recovery when economic conditions begin to improve. During crisis cluster affiliated firms obtained some advantages against firms located outside in aspects such as productivity and competitiveness.

Once the period of economic recovery had begun, in 2014, affiliated enterprises recorded a certain upturn in turnover, level of activity, and operating margin, whereas non-affiliated ones recorded a downturn. This would suggest that being part of an association does indeed provide certain advantages, which exert their influence not so much during the downturn but during the recovery. This appears not to be an effect of size that is not significant. Affiliated companies recorded better results in the indicator value added/employees in 3 of the 4 years analyzed. It may therefore be stated that affiliated companies generate more wealth than non-affiliated ones. Perhaps the most important thing to note is that this ability to generate growth in sales is what really helps affiliated companies to better come out from recession. The differences found between Chap. 14 and Chap. 15 are in no small part due to the fact that the Basque Country is more based on clusters, rather than the industrial districts and their socioeconomic fabrics characterized in Chap. 15 in Italy.

6 What Is the Role of Collective Actors and Local/Regional Policies in ID/Cs Upgrading and Path Renewing?

ID/Cs evolve because of the influence of spontaneous changes and deliberate collective actions. Chapters 4, 11, and 16 contribute to developing this line of reflection. In Chap. 4 (Jankowska and Götz), the case of the Polish boiler-making cluster, in the region of Wielkopolska, illustrates how a cluster organization supported by EU funding has organized several cooperative innovative activities, in research and in the adoption of more ecological standards, among the SMEs belonging to the ID/Cs. The top-down assistance of a cluster organization has also played a distinguished role in promoting the internationalization process of the cluster. For years, local supporting organizations have been focused on providing ID/C firms specialized services, fostering innovation. Nowadays, thanks to the increasing connectivity, they have become knowledge catalyzers and gatekeepers of knowledge, mediating between local and extra-cluster firms. This is also similar to the main contribution from Chap. 11 (Belso, Lopez-Sanchez, and Mateu-Garcia). Using data collected in the Toy Valley in Spain, this chapter analyzes brokerage behavior. Firms and supporting organizations exchange different types of knowledge (technical and market knowledge) in different ways. Endorsing micro-level polymorphism in clusters, this study verifies that cluster actors perform diverse roles when transferring different knowledge. Market knowledge is brokered by a much more reduced set of actors, thereby suggesting more selective knowledge diffusion. In the cluster, technical knowledge is mediated by universities, by a technological institute (a research-transfer office, AIJU), and by a local toy business association (AEFJ). This suggests that being a broker depends on certain micro-level characteristics. Several organizations are able to mix market and technical knowledge, thanks to a wide number of relationships, helping to circumvent potential technological bias. Surprisingly, despite their technological focus and limited coordination, universities mediate both technical and business knowledge. While suppliers or toy manufacturers import knowledge from outside producers, local organizations mostly focus their gatekeeper activities on other local supporting organizations.

Inspired by the recent literature on smart specialization policies, Chap. 16 (Belussi and Trippl) examines 16 regional cases in which cluster polices have been recently developed, distinguishing among well-developed, intermediated, and less developed regions. An interesting frame has been developed by the authors, which distinguishes between continuous and discontinuous—radical or breakthrough—pattern of change.

Types of regional industrial path development

Form of path development		Key characteristics
Change	New path creation	Rise of entirely new sectors deriving from breakthrough innovations
	New path entry of established industries	Setting up of an established industry that is new for the region, often based on the inflow of FDI
	Path ramification	Ramification-speciation of knowledge of existing industries into new but related ones industries
	Path upgrading and renewal	Major change of an industrial path into a new direction based on new incremental/radical innovations or new organizational forms
Continuity	Path extension	Continuation of existing industrial paths based on incremental innovation along established technological trajectories (danger of path exhaustion)

Source: compilation from a modification on Trippl et al. (2016)

The category of path extension reflects the continuation of an existing trajectory. Path upgrading and renewal are related to the introduction of new incremental or radical innovations in ID/Cs. Path ramification relies on the introduction of new sectors through a process of "speciation," through knowledge recombination. New path entry describes the setting up of an already existing specialization in a region in the cluster (this sector is new for the region but is not new for the market). A new path creation (the emergence of a new specialization based on breakthrough innovations) represents a truly novelty for the region and recalls the rerouting strategy discussed in Chap. 12. In the analysis of the application of smart specialization policies, this chapter also discusses the issues of "prioritization" and "stakeholders involvement."

Overall, throughout this contributed volume and having analyzed the main results, the editors point out the following important key issues or *take-aways*:

- Agglomerations exert asymmetric benefits on located firms; benefits can also be negative, observing a rather negative influence caused by excessive competition, a fact mainly encountered in service firms such as hotels. Similarly, and taking an overall picture, positive agglomeration effects during early stages are replaced by congestion effects in latter stages (from Chaps. 2 and 7). The latter can also be strengthened through cognitive inertia (Chap. 6). Related results in science parks, as an alternative form of agglomeration, clearly indicate that firms tend to be more innovative in the growth stage (first 3 years of collocation), and then, after 6 years, the benefits of belonging to the science park are harder to be identified (Chap. 9).
- Radical innovation in clusters and industrial districts needs new firms with technology distant (to the cluster) that can complement the traditional role developed by leading incumbents or technological gatekeepers (from Chap. 6).

Mature evolved clusters and industrial districts present many different types of evolution regarding their type of innovations (from continuation of existing industrial paths to raising entirely new industries from radical innovations) (Chap. 16).

– As clusters evolve and become successful (Mark III), clusters and industrial districts are more open to global knowledge, there is a high presence of multinational companies, and clusters overcome inertia, income-seeking behaviors, and coordination problems, showing complementary codified knowledge together with tacit knowledge and the role of gatekeepers or trans-local anchor firms still being very important (Chap. 12).
– Industrial districts are very innovative, compared to manufacturing areas where large firms predominate, nonspecialized manufacturing areas, and large metropolitan areas. Industrial districts, therefore, cannot be considered as weak innovation systems (Chap. 3).
– Globalization is creating networks of firms among different far-distant clusters, beyond global value chains, and mature districts (with less agglomeration benefits) are driven by homegrown multinationals that act as multinational companies seeking advantages in different clusters across countries (Chap. 10).
– Multinationals do invest in clusters and industrial districts, seeking knowledge available in those agglomeration by collocation. Also, there is a positive impact of the presence of foreign affiliates of MNEs on the sustainability of the ID socioeconomic fabric (Chap. 5).
– In socioeconomic and highly agglomerated areas such as industrial districts, natural disasters or crises with their negative impacts are slightly higher for the firms located in industrial districts than for those outside such areas, thereby suggesting that, at least in the short term, the usually positive cumulative processes associated with localization within an agglomerated area may reverse and magnify the negative impact of a disruptive exogenous supply shock (Chaps. 13 and 15). Recovery is also accelerated after crisis. Affiliation or association to clusters (with less social capital than in IDs), however, can also mitigate the effects of crisis and accelerate recovery (Chap. 14).
– Supporting organizations (research-transfer offices, associations, etc.) play a prominent role in clusters and industrial districts and broker differing types of useful knowledge along different circuits (Chaps. 11 and 4) and with different performance consequences.
– The boundaries of the concepts industrial districts and clusters are being extended toward managerial literature, confirming a major shift toward management-related topics, where innovation and firm performance are the leading issues (Chap. 8).

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