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**On the evolution of the Castel Goffredo hosiery
cluster: A life cycle perspective**

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Abstract

The *life cycle* approach has become popular in studies on industrial clusters. However, some concerns have been raised over the inherent determinism of this approach and its tendencies to focus exclusively on cluster internal dynamics while neglecting the role of external factors and socio-economic contingencies. This paper addresses these criticisms by investigating the long term development of Castel Goffredo, a traditional textile cluster in Italy. In our analysis we identify and characterise the main stages of the life cycle and its antecedents. We singled out the main triggering factors behind each of these stages and show that a variety of factors, both external and internal to the cluster, contributed to its development. Our findings confirm that an *adaptive* cycle approach, which focuses also on contingencies and external factors, appear to be appropriate for investigating the long term evolution of clusters.

Keywords: cluster life cycle, industrial cluster, hosiery industry, evolutionary economic geography, complexity, industrial districts

Jel codes: R1, R12, O1.

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1. Introduction

In the wake of the widespread application of evolutionary approaches in economic geography (Boschma and Martin, 2015), the literature on industrial clusters has paid growing attention to questions concerning the emergence and evolution of clusters (Boschma and Fornahl, 2011; Fornahl, et al. 2010; Fornahl et al., 2015; Fornahl and Hassink, 2017; Belussi and Hervas-Oliver, 2017). This renewed interest in dynamics has spurred a variety of theoretical frameworks centred around the concept of ‘Cluster Life Cycle’ – henceforth CLC- (Menzel and Fornahl, 2009). Building on the product life cycle model (Utterback and Abernathy, 1975; Klepper, 1996), this approach identifies the stages through which a cluster develops from its emergence till its maturation and decline, and the evolutionary mechanisms behind them. The inherent determinism of this model has however raised some concerns in the scholarship (Martin and Sunley, 2011). Similarly, it has been argued that a CLC framework tends to neglect the role of external factors in shaping cluster evolution, while giving central stage to firms’ endogenous dynamics (Tripl et al. 2015; Martin and Sunley, 2011). Overall, it has been made a plea in the literature for a wider application of evolutionary cycle frameworks to a larger number of empirical cases in order to test their theoretical validity and reliability (Boschma and Fornahl, 2011; Belussi and Hervas-Oliver, 2017; Fornahl et al, 2015). This paper takes up these challenges and addresses the above criticisms by investigating the long term development of a traditional textile cluster in Italy, namely the hosiery cluster of Castel Goffredo. In doing so, this work wants to provide a testing ground for the CLC approach. It aims at showing that the cluster evolution tends to follow *adaptive* trajectories, instead of rigid stages of development. In line with other studies, it adopts a multiscalar approach and builds a typology of internal and the external *triggering* factors to unveil the cluster development trajectories (Tripl et al. 2015; Santner and Fornahl, 2014).

Castel Goffredo is the largest textile manufacturing complex in Italy specialised in the production of hosiery and hosts some of the world leading companies in this industry (e.g. CSP international, Golden Lady). The cluster took-off in the early nineteen fifties, and achieved a world leading position in the 1980s. Since the late 1990s, it fell into a structural crisis, which was exacerbated by the 2008 financial crisis (NOEMITrust, 2013).

Our findings suggest that a complex system approach is an appropriate theoretical framework to investigate the evolution of clusters (Martin and Sunley, 2011). More broadly, this case study contributes to the recent empirical literature on cluster evolution by using an evolutionary cycle conceptual framework (Fornahl et al, 2015).

The paper is structured as follows. After the introduction, section 2 is devoted to outline the theoretical foundations of the work. Section 3 presents the main features of the case study and the

research design. Section 4 illustrates the stages of development of the cluster, which are further discussed in section 5. Section 6 concludes by highlighting the contribution and limitations of the study.

2. Theoretical background: evolutionary approaches to cluster evolution

Following an evolutionary perspective to economic geography (Boschma and Frenken, 2006; Boschma and Martin, 2007 and 2010), a recent literature has investigated the evolution of clusters in an attempt to provide a systematic interpretation of the dynamics affecting their ‘ageing process’. Scholars have developed different conceptual frameworks of cluster evolution, perhaps the most prominent are the *life cycle* (Bergman, 2008; Brenner, 2004; Crespo, 2011; Menzel and Fornahl, 2009; Shin and Hassink, 2011) and the *adaptive cycle* (Martin and Sunley, 2011; Pendall et al., 2009; Simmie and Martin, 2010), which share a similar research agenda.

The concept of *life cycle* derives from a biological metaphor, which has been widely applied in the field of industrial economics to show how sectors to move from rise to maturity and decline (Klepper, 1996). In the same vein, scholars have observed that the same metaphor could fit effectively also with the study of industrial clusters, being entities with a multi-faced and complex nature.

A canonical life cycle analysis of a cluster is usually carried out from a historical perspective, by pondering on factors of both quantitative and qualitative nature (Kohler and Otto, 2008; Bergman, 2008; Menzel and Fornahl, 2009). The model sees clusters moving - more or less linearly – through four different stages of development: emergence, growth, sustainment and decline. Whilst determinant factors responsible for clusters’ *emergence* seem to remain largely governed by chance events, scholars have also discussed about the importance of local path-dependence and economic environment (Boschma, 2007; Fornahl et al., 2010), as well as strategic action of regional actors – the latter being able, in particular, to foster the creation of new knowledge and innovation. The subsequent stages of *growth* and *sustainment* are essentially seen as processes of specialization and selection driven by cumulative causation, spin-offs formation and imitation of best practices (Klepper, 2007; Boschma and Wenting, 2007). While developing, however, clusters generally tend to decrease in heterogeneity and such ‘myopic process’ might result into deleterious lock-in if isomorphic pressures become too high (Malmberg and Maskell, 2010; Hassink, 2005 and 2010), hence bringing these agglomerations to decline.

In recent years, however, in concomitance with a critique to the equilibrist perspective of path-dependence (Martin, 2010) and the introduction of the dynamic notion of regional resilience

(Foster, 2007; Swanstrom, 2008; Hill et al., 2008), scholars have appealed for different theoretical concept: i.e. *adaptive* cycle (Pendall et al., 2009; Simmie and Martin, 2010; Martin and Sunley, 2011). From this latter perspective clusters are seen shifting their form and nature over time, depending by varying levels of capital accumulation and connectedness, which are likely to shape the overall resilience of a system. The main claim of an adaptive model is that cluster trajectories may significantly differ from a ‘bell-shaped’ life-cycle. In this regard, although bearing remarkable similarities with its predecessors, the notion of adaptive cycle is based on an ecological metaphor, rather than on straight biological one. As such, it allows for a much more flexible analysis of the complex – and, hence, not deterministic – processes of cluster evolution (Martin and Sunley, 2011). Some of the above criticisms have been recently taken up by evolutionary scholars, who have elaborated and empirically tested a variant of the CLC approach (Belussi and Hervás-Oliver, 2017; Fornahl et al. 2015), which gives room to multiscalar socio-economic dynamics (Santner and Fornahl, 2014; Martin and Coenen, 2015), the role of agency and exogenous factors (Livi and Jeannerat, 2015; Rodriguez et al. 2017).

In particular, Trippel et al. 2015 advocate for a multiscalar approach, which will allow to acknowledge the role played in cluster evolution by different socio-economic processes, besides firm heterogeneity, that operate at different spatial scales (i.e. exogenous, endogenous).

Similarly, Bellussi and Sedita (2009) show that cluster evolution is driven by a variety of ‘triggering factors’, which are the strategies of de-locking that are either explicitly or implicitly adopted by clusters in order to cope with on-going challenges.

Triggering factors and cluster evolution

Building on this latter works we identify a typology of triggering factors that are behind the emergence, growth and maturity as well decline/renewal of a cluster. These triggers include both conventional factors usually identified by the Marshallian literature on industrial districts and clusters, as well as those put forward by the evolutionary approaches in economic geography (Martin and Sunley, 2006; Belussi and Sedita, 2009). They can be either endogenous or exogenous and are likely to be adopted in different stages of the life cycle and finally that they can generate a variety of different spatial patterns of cluster formation (e.g. spread or concentrated).

The *emergence* of a cluster is usually traced back to some initial pre-conditions, which refer to the presence in the local area of historical vestiges, along with common social and cultural background. These factors favour the formation of trust, reduce opportunistic behaviours, and ultimately enhance cooperation and collective learning (Capello and Faggian, 2005). Local pre-conditions can also include tangible endowments, like the abundance of natural resources or the availability of human

capital, either in the form of generic skills or specialised craft skills. Local institutions, such as universities or technological centres can play a role in the pre-formation stage of a cluster. They form a class of technicians, managers and in some instances future entrepreneurs, besides acting also as cluster enabling factors (Feldman, 2005). Also financial institutions, in the form of either local rural banks or venture capital have been acknowledged as key determinants in the formation of both traditional and high tech clusters.

Besides internal factors, exogenous factors in the form of anchor firms and multinational enterprises constitute another important determinant of cluster formation (Lazerzon and Lorenzoni, 1999). Their impact is either direct, when they contribute for example to establish extensive subcontracting networks, or indirect, via spin-off that populate the local area of new start-ups.

Table 1 **Triggering factors and the Cluster Life Cycle**

	Emergence	Take off & Growth	Maturity, Decline Renewal
Internal	Local pre-conditions Serendipity	Technological change Cost leadership Spin off dynamics Local institutions	Diversification and differentiation Cost leadership Technological change
External	Anchor firm, MNCs Local institutions	Globalisation Demand growth	Globalisation FDI & MNCs Global and national policies/institutions

Source: adapted from Belussi and Sedita, 2009 and Martin and Sunley, 2006

The emergence of a cluster is also the outcome of a combination of factors where chance events play a prominent role. Historical experiences indeed suggest that serendipity has been an important *explanandum* of why a cluster emerged here instead of there (Jovanovic, 2008; Boschma and Frenken, 2006).

Once established, the *growth*, *maturity* and *decline/renewal* phases of cluster evolution can take multiple path dependent trajectories, which are affected by a variety of factors, also those already working at the initial formation stage. Technological change is a key endogenous determinant both during growth and subsequent phases. Technological innovation confers a cluster with new competitive advantages which speed up growth during the take-off phase. At later stages, when the cluster reaches maturity, it provides opportunities for renewal towards new sectors and markets.

Cost leadership is a common strategies used by firms during the take-off stage. In particular lowering labour costs has been a key competitive advantage of traditional industrial districts in mature industries (e.g. garments and shoes in Italy) as well as of some high-tech clusters (e.g. ICT and electronics in China/India). However, this strategy is a double edge blade, in particular during the cluster maturity phase, reliance on cost reduction can lock a cluster into already declining

activities, so it prevents local actors to divert resources from slow to fast-growing activities. As suggested by Belussi and Sedita (2009: 510), this trigger is strongly path dependent and leads to lock-in trajectories.

Spin-off formation plays a role both during the emergence and growth phases, as successful firms provide role models for their employees. As shown in a variety of cases (Klepper, 2007; Cusmano et al. 2015), spin-offs dynamics bring variety to a cluster and contribute to its long term development.

Local institutions play a triggering role during the all life cycle. In some instances they co-evolve with the cluster becoming a proper endogenous factor, which adapts itself to the cluster long-term trajectory (e.g. vocational school become specialised; bank offer tailor made assistance; sectoral technological centres). However, local specialised institutions can also prevent change and reduce adaptability (Grabher, 1993; Hassink, 2005).

Globalisation is a key driver during both the growth and subsequent phases. It provides a cluster with both opportunities and threats. On the one side it opens up new markets and fosters demand growth. On the other side, it lowers entry barriers and pushes clusters to adopt defensive strategies (via cost leadership), such as relocation of manufacturing activities abroad, which eventually lead to the decline of the cluster. However, it can also spur a diversification process, where cost leadership is accompanied by market segmentation strategies and upgrading. In this latter case clusters retain the high value-added functions, and at the same time offshore low-end activities (Humphrey and Schmitz, 2002). These diversification strategies are often coupled with global partnerships. Such diversification and reorganisation processes are often shaped by multinationals, which bring new product lines and green field investment to the cluster (case Mirandola, etc). Under these circumstances, local and national institutions can play a proactive role in building a favourable context, either in terms of fiscal incentives or common goods (e.g. specialised workforce and suppliers; technological assistance).

The framework sketched above will be used to in the next sections to single out and analyse the triggering factors that at different spatial and socio-economic scales affected the evolution of the Castel Goffredo hosiery cluster.

3. Case study and research design

The Castel Goffredo hosiery cluster

The cluster of Castel Goffredo is located in the province of Mantua, in eastern part of the Lombardy region (Italy) and spreads over the two neighbouring provinces of Brescia and Verona, which are at

the core of the so called *Third Italy*. The cluster is traditionally specialized in the stocking industry, and is made of small and medium enterprises that work as subcontractors for large firms. Since the 1960s, the cluster is one of the largest European textile industrial complex, which ranks high both in volumes of production and export. The cluster accounts for 75%, 60% and 23% respectively of the national, European and worldwide production of hosiery, for an average total annual turnover of more than 1 billion euros (Osservatoriodistretti.org, 2011). In recent years, some firms in the cluster have also diversified part of their production by developing new product lines (e.g. seamless, underwear, technical hosiery) and upgraded functionally by creating its own distribution channels via franchising and own retail shops (e.g. Golden Lady Point; Intimissimi; Pompea Shops) (Capasso et al., 2013). Despite the growing and tough competition from Asia, the cluster has been able to maintain an edge as far as the high-end and fashion oriented segments of the market are concerned and still hosts some of the world leading companies in the sector (e.g. CSP international, Golden Lady) (Cavestri, 2012). However, looking at its recent evolution, we observe that since the late nineties the total number of companies active in the local hosiery industry has almost halved, from about 440 units to about 254 in 2016. After the 2008 financial crisis, the economic landscape in the cluster has further deteriorated (De Stefani, 2012). The double effects of the crisis and the process of firms' vertical integration, which was also accompanied by the introduction of labour saving automation processes, have brought about a substantial drop in the overall level of employment, from about 9,800 employees in 2009 (i.e. both hosiery and underwear sectors) down to 7,400 in 2016 (SMI, 2017). Due to the combined effect of vertical integration and globalisation, the turnover of the 13 largest companies in the cluster has reached 80% share of the total, with the four largest companies (i.e. Golden Lady, Filodoro, CSP, Levante) accounting for about 50% of the total. In other words, not differently from other Italian clusters (Rabellotti et al, 2009; Randelli and Boschma, 2012), in recent years the cluster has repositioned itself and reshaped its organisational structure in order to better cope with the challenges of globalisation. These processes have possibly brought about the emergence of new specialisation patterns, the formation of business groups among local firms and a trend towards concentration.

Research design

In order to unveil the triggering factors behind the cluster evolution, this work presents a longitudinal investigation using both primary and secondary data sources. The analysis covers a period of about 80 years, starting in 1921, when a chance event triggered the process that eventually led to the foundation of the first company in the cluster (Arrighi, 1988). Historical sources (e.g. companies archives, newspapers, specialised literature, reports of local banks and government),

academic literature and in-depth interviews to experts, entrepreneurs and local stakeholders were used to reconstruct the history of the cluster and analyse its long term evolutions. More in details, the research design builds on the following keystones:

- a) Identification of the population of firms in the cluster: by collecting firms' data from the register of the local chamber of commerce, we built an original historical database which allows us to investigate the firms entry-exit dynamics and their spatial distribution.
- b) Historical analysis of the cluster emergence: in order to investigate the antecedents and triggering factors behind each stage of the cluster life cycle, we reviewed business reports and collected through in-depth interviews relevant historical evidence about the cluster and its members (e.g. companies, local government, supporting organisations). In order to get access to more nuanced information about the cluster socio-economic dynamics, during a period of six months, we organised two focus groups and carried out six interviews with local stakeholders, who had different types of engagement with the cluster and a rather heterogeneous background. The focus groups were lasting for about two hours each. In each focus group three participants were involved. The first focus group was composed by two retired workers and one entrepreneur still active in the business; these actors were chosen because of their experience during the early formative years of the cluster. The second one was conducted with three representatives of a local cluster development agency: two of which had experience as businessmen. The six individual semi-structured interviews were lasting for about one hour each: three of them involved local entrepreneurs; one was conducted with a representative of a local labour union and the two remaining ones with local experts (i.e. two academic professors who investigated the development of the cluster over its long history).

Based on these sources of information we were able to: identify the stages of cluster development and characterise their key features; identify the triggering factors of each stage of the cluster life cycle, and the mechanisms that allowed the transition from one stage to another; reconstruct the evolutionary mechanisms enabling each cycle and the path-dependent trajectories followed by the cluster.

4. The historical evolution of Castel Goffredo hosiery cluster

The antecedent phase: 1921-1956

The history of the Castel Goffredo hosiery cluster can be traced back to 1921, when a political murder that took place in town had as protagonist the to-be entrepreneur Mr. Delfino Eoli – known

as an early and fierce fascist (Arrighi, 1988)¹. Somehow involved in this case, he was forced to leave the country and expatriated to Chemnitz, Germany, where he was hired as technician for some local textile companies. Thanks to these job opportunities, Mr. Eoli gained considerable experience and became highly knowledgeable in that specific trade. After some years, namely in 1925, the to-be entrepreneur was allowed to return to Italy, when Fascists, the political party Mr. Defino Eoli belonged to since its early days, went on power both in Mantua and Italy. Therefore, when back to Castel Goffredo, Mr. Eoli found a rather a favourable political environment for starting up a new business activity. Thanks to the professional experience gained abroad, he decided to start up a new entrepreneurial venture in the textile industry; for that he teamed up with his brother Oreste, who was a skilled accountant, and the engineer Achille Nodari, who was the mayor of Castel Goffredo at that time. Two contingent factors played an important role in this initial period. First, the abundant supply of workers, which became available in the local labour market²; second, Mr. Eoli became a highly influential figure in the local political community, therefore, he could obtain generous support from the local government, and he was able also to import new machineries and hiring skilled technicians directly from the German factories he worked for when exiled. This combination of contingent factors lead eventually to the establishment of the first hosiery factory in Castel Goffredo, the 'NOEMI Strumpfabrick', which was a vertically integrated firm relying on the 'cotton looms' technology (Arrighi, 1988).

In the early 1930s, Noemi employed more than 500 workers. In the begging the company produced a rather generic fabric based on silk materials and manufactured all sorts of textile products. The type of technology adopted by Noemi allowed a great degree of flexibility, since looms could be re-arranged and calibrated according to the output needed. However, these machines required also considerable investments, both in the forms of physical capital that was needed for their installation, and human capital, that was required for operating them³. For this reason NOEMI remained for decades the only hosiery company in town. The situation changed after WWII, when the increasing disagreements between the two brothers-managers, Oreste and Delfino, resulted in 1955 in the departure of the latter. Once lost the entrepreneurial skills of its key founder, NOEMI entered in a deep period of crisis that progressively led employees to leave the company⁴.

¹ During the early 1920s, the fascist regime was taking over the country. In the North of Italy, where socialists and trade unions had their strongholds, fascist brigades used to attack and destroy their organisations. Political harassment and violence, including murdering, were not uncommon.

² This was possible because of the diffusion of labour saving technologies in agriculture, which expelled peasants from their land and pushed them to look for alternative jobs in the incipient manufacturing activities and because of the nearby silk industry, which provided high-skilled craftsmen.

³ A skilled machine operator would require at least two years training to become competent enough to use efficiently the looms (Leoni, 1992).

⁴ By the end of the fifties (i.e. 1958) the company ceased its activities, though it was declared officially bankrupt in 1974.

It can be argued that the emergence of the cluster itself begins with the crisis of NOEMI, when we observe the first agglomeration of stocking companies (Lazerson and Lorenzoni, 1999; Brunetti et al. 2000). They entered the industry during the crisis of Noemi and in particular immediately after its collapse. These companies were founded mainly by former employees of Noemi, who had considerable expertise in the industry and specific knowledge of how to run the business.

At this point in time, an important opportunity for this first wave of spin-offs was provided also by the neighbouring mechanical cluster of Brescia, which is located just 50km away from Castel Goffredo. The mechanical companies of this cluster were able to design and manufacture some improved and relatively cheap model of the circular hosiery knitting machine⁵. The adoption of this technology will prove to be one of the most important triggering factors for the cluster during its take-off stage.

The take-off and the initial growth of the cluster: 1957-1975

After the success of the early entrants, many others flocked into the industry, trying to replicate the same successful business model based on the hosiery production. As said above, a considerable share of these new activities were founded by former employees of existing stocking companies, and in particular many had worked for NOEMI (e.g. *Calzificio Maggi*, *Calzificio Principe*). These entrepreneurs would invest their savings (chiefly deriving from agriculture) for purchasing machineries, and would transform barns, stables and basements of their rural households into small factories. Such activities, could also took advantage of the organisational flexibility characterizing the aspects of the previous rural economy, essentially based on the interchangeability of tasks between family members. When the success of these early entrants became blatant, new start-ups were also founded by entrepreneurs who were active in different sectors. With this second wave of entries the cluster begins its take-off stage. According to register data, the population of firms grew exponentially since 1957 (see Figure 1): in less than six years more than 100 companies were founded. The 1960s represents notoriously a period of economic booming in Italy, in particular as far as the textile industry is concerned (Leoni, 1992). The introduction of the nylon fibre completely revolutionized the commercial idea of hosiery: being initially a tiny niche market, it suddenly turned into a mass-market product. In addition, a radical cultural change in the canon of fashion, i.e. the diffusion of short dresses and mini-skirts, facilitated also the adoption of hosiery. This shift in fashion spurred a sharp increase in the demand for hosiery. The companies from Castel Goffredo

⁵ It is alleged that circular machines were already present in NOEMI's fleet, and that engineers from Brescia had a chance to inspect them during the many visits they paid to Noemi (Leoni, 1992).

reacted promptly to these new opportunities by adapting their product portfolio, so they were first-movers into this new market segment.

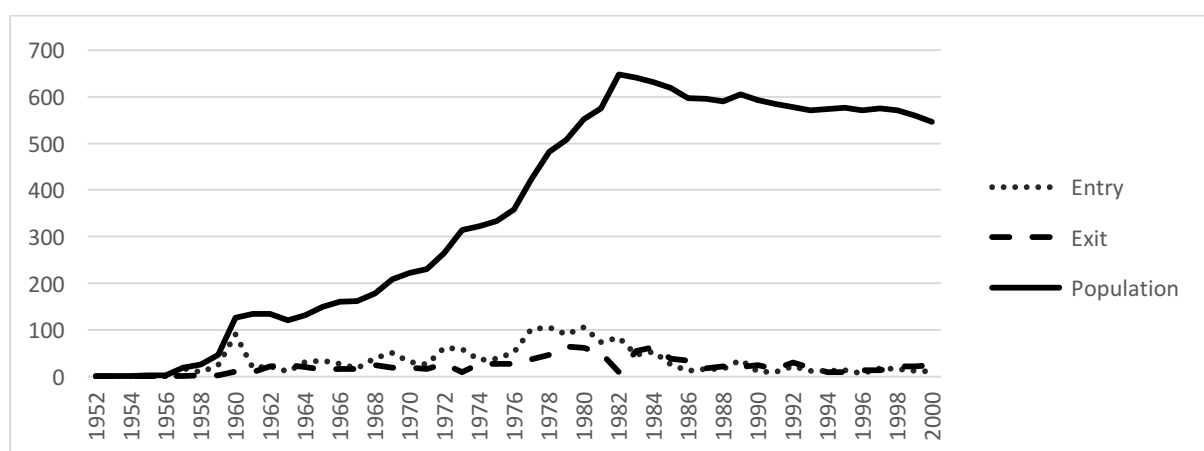
On the supply side, what made possible to a multitude of small firms to successfully react to these market changes was also the adoption of circular machines. Circular machines represented a radical technological break-up with the past, and had a tremendous impact on the industry because, differently from looms, they could be adopted and operated without undertaking any large sunk investment in either physical or human capital. This made them very accessible also for relatively small firms. The production of hosiery by means of circular machine remained for long time almost a cluster unique feature, since other well established textile complexes in Europe thought the demand for hosiery would not last for long, representing in their view just a temporary fashion trend. During this initial period, these companies and wholesalers preferred to purchase hosiery directly from Castel Goffredo suppliers. Consequently they entered relatively late in direct competition with the cluster's companies, which in the meantime managed to grow and consolidate their position in the market. In the period 1974-1975, thus after almost twenty years from the establishment of the cluster, more than 300 companies were present around Castel Goffredo. Looking at entry-exit data of the population of firms, it can be observed that the growth of the cluster was from the very beginning highly turbulent. In addition, it is documented that, during this period of time, the cluster went through at least one major crisis in concomitance with the renewed competitiveness of the German industry in 1963, which caused several failures. In order to overcome this crisis, local institutions (i.e. local rural bank) set up the 'Socks' International Fair', which contributed to increase the international visibility of the cluster. The fair was organised for three consecutive years, however, our respondents indicated that as soon as the economic situation of the cluster improved, the project wrecked due to the lack of support by the local companies, which showed to have conflicting interests.

From crisis to further growth 1976-1987: the golden age

In 1975, rumbles of an incumbent general economic crisis pushed local government to declare Castel Goffredo and contiguous areas as an economically depressed area, therefore substantial support in the form of tax-breaks was provided to local companies. These measures helped on the one side incumbent firms to lower their production costs, on the other side it also contributed to further expand the spin-out system, with the formation of a specialized subcontractor belt around Castel Goffredo. The outsourcing process became a key element for the renowned productivity and flexibility of the cluster in that period. Starting from 1975-76, the number of enterprises skyrocketed: in less than 8 years the number of companies doubled (peaking to 650 units in 1982).

The majority of these new entries were made of family-based workshops specialized in one or few stages of the hosiery production (including packaging). In short, the cluster had acquired the features of the typical Italian industrial district based on subcontracting, flexible specialisation, small size and horizontal relations between firms (Becattini, 1990; Piore and Sabel, 1984). In terms of hosiery production, Castel Goffredo outcompeted many other textile complexes in Europe and became a world leader (Testa, 1993). The cluster was able to combine flexibility, cost effectiveness and a high price/quality ratio. This performance was partly due to the lower labour costs and tax break, but also the result of a fierce horizontal competition between firms in the cluster. Interviews reveal that in this period the relations between firms tended to be embittered by the inclination of entrepreneurs to copy each other's strategies, thus resulting in continuous innovations of their firms and activities, but also distrust and less cross-collaboration. In addition, the overall costs of production were lowered by the extensive presence and use in the cluster of deregulated and unregistered manpower, in fact the total amount of workforce in the system was estimated about 7000 employees in those years, but one third of them was off the book and therefore not taxed⁶. From the early 1980s, due to the increasing importance of international markets and the changing trends in fashion, the turbulence remained high both for entries and exits, but from 1983, the latter started to overcome the former (see Figure 1). The cluster started its transition toward greater vertical integration, driven by large firms who implemented new competitive strategies consisting in: product differentiation and quality upgrading; brand promotion; wider application of managerial practices to all company functions; new distribution and promotion channels for reaching out international markets; adoption of labour saving technologies and production processes.

Figure 1 Firm Entry-Exit dynamics in the Castel Goffredo cluster



⁶ Due to the presence of off-the-book workers, Castel Goffredo's entrepreneurs were also accused of 'unfair competition' from their European competitors, who were, however, eventually unable to win the lawsuit against them (Cipolla et al. 1999)

Stabilisation and incipient decline: 1988-2015

From the second half of the eighties Castel Goffredo had to cope with the challenges of the ongoing globalisation of markets. This shift in the macro-economic scenario, plus a new turn in fashion along with environmental changes (e.g. climate change and increase in temperature) were all factors that negatively influenced the consumption and demand of hosiery. We observe indeed that from 1987-88 till the 2000s the overall population of firms in the cluster slightly decreased (respectively from 598 to 594 units). This small decline represented a discontinuity with previous decades - which were characterized by massive entries.

The scaling up of firms favoured technological upgrading, which turned into higher quality and production efficiency: e.g. texturing's efficiency was doubled, the speed of circular machines was triplicated, and automation and computerisation speeded up the packaging phase. In addition, both large and small firms improved their export channels and networking capacities.

Local institutions started providing more tailor made services, indeed a dedicated technological centre, the 'Centro Servizi Calza' was established in 1989 under the initiative of local government and the local bank. This local organisation had the twofold objective of endowing the cluster with a specialized technical service and a proper governance structure⁷.

The cluster started its repositioning to the high-end segment of the market. Till mid-nineties, competition from Asia produces did not seem to affect significantly the cluster, which was still much ahead these potential competitors.

However, since early 2000s external forces, i.e. adverse macro-economic conditions, started to undermine the cluster fitness. It was possible to cope with the decreasing pattern of demand of the Italian national market by increasing the overall foreign export to Northern and Eastern European countries. However, globalisation notably brought to the cluster much more rivals than opportunities, in particular producers from Turkey and China managed to take over the low-end segment of the market. In order to cope with such new challenges, the cluster leading companies increasingly offshored their labour-intensive activities, causing de facto the crisis of many local subcontracting firms. In such scenario, the financial crises of 2008 contributed to worsen the situation. Product differentiation and quality upgrading became even more crucial strategies for small and medium size firms. Some of them managed to enter the high-end markets of haute couture or diversified in small market niches (e.g. medical hosiery). It has to be noted however

⁷ However, according to internal reports, in 1996, seven years after its foundation, barely a 15% of cluster's firms were associated, while only a 32% of them effectively made use of its services. The main claim of the entrepreneurs interviewed is that the R&D activities provided by Centre did not address some of the main weaknesses of the cluster (e.g. training; access to credit).

that although diversification proved to be an effective strategy, it worked well only for a limited number of firms which were capable and willing to enter these new trajectories.

Overall, in the 2010s the cluster partly recovered, though some structural weaknesses seem not yet addressed (e.g. technical training; R&D facilities; a proper governance structure). In such a context, the cluster is struggling to find a proper path of renewal.

5. Discussion

Anchor firm as initial trigger

The period that goes from the establishment of Noemi till its bankruptcy represents the embryonic phase of the cluster. The triggering factor that sets the basis for its emergence is the establishment of an ‘external’ anchor firm - i.e. NOEMI company- which brought to Castel Goffredo innovative technologies, new skills, and competences that did not exist in the local territory (Belussi and Sedita, 2009). Although serendipity played a role in this process— since, arguably, Noemi’s foundation was the outcome of a long chain of chance events –, the emergence of a new industry was possible thanks to a combination of place-dependent favourable conditions and contingencies, which clearly went beyond firm dynamics and in particular referred to a favourable political climate (i.e. Delfino Eoli’s role in local politics). Therefore the birth of NOEMI was the outcome of an idiosyncratic process spurred by a chance event, path-dependence and strategic action, where also external factors (e.g. physical capital and skilled workers from Germany) played an important role (Trippl, et al. 2015). After a few years of activity, the growing disagreements among the founders and the consequent collapse of Noemi represented by itself the key event that lead eventually to the cluster emergence, which is typical also of other Italian industrial districts (Lazerson and Lorenzoni, 1999).

Spin-off dynamics and technological collaboration

At the base of this first expansion of the cluster we observe a typical process of spin-off formation (from NOEMI), with imitation of best practices (Klepper, 2007). This process was amplified also by local cultural values (strong familiar and competitive entrepreneurial culture) and social capital (capacity of local actors, linked by bonds of trust, to associate in small groups in order to start a firm). Besides these internal dynamics, it has to be pointed out that in this early phase of development, the rise of the cluster was undoubtedly favoured by external factors, i.e. the presence of the mechanical cluster of Brescia, as well as contingent macro events, such as the cultural turn of the sixties and the overall favourable macro-economic conditions of that period (Trippl et al, 2015).

Internal factors were crucial however to fully exploit these exogenous conditions. Local entrepreneurs soon realised the market potential of hosiery, so the quick adoption of circular machines gave them a considerable competitive edge over other competing clusters that underestimated the potential of this innovation.

Cost leadership and sustained growth

Cost-leadership is beyond dispute the driving force behind the extraordinary growth of the cluster. Following Belussi and Sedita (2009), cost leadership is a triggering factor typical of a maturing phase. In the case of Castel Goffredo we observe a peculiar trajectory of growth fuelled since the beginning by cost leadership, also supported by specific local policies. Therefore, differently from a canonical life cycle model, we observe that after the initial growth, the cluster continued to grow further, despite some short crisis, as shown also by the entry/exit dynamics of firms (Martin and Sunley, 2011).

As pointed out in our theoretical framework, this trigger is path dependent and can generate lock-in trajectories. Indeed, in the cluster it diverted resources away from more important areas of intervention, such as training, innovation and diversification, which remained instead largely neglected. While cost-leadership remained the driver through the whole duration of the growth and stabilisation phases, large firms started a parallel trajectory of differentiation in order to maintain a competitive edge over foreign rivals. However, their strategies did not imply a significant renewal of the cluster core functions (Chapman et al., 2004; Todtling and Trippel, 2005; Malmberg and Maskell, 2010). Till the 1990s the cluster remained organisationally thin, industrially monothematic and basically dependent from the production and export of one single product (i.e. women hosiery).

Table 2 Cluster Evolution and Triggering Factors

Period	Triggers		Internal	External
	Stages			
1921-1955	Antecedents		Anchor firm	Political context
1956-1975	Take off & Initial growth		Spin off dynamics, adoption of technology (circular machines)	External collaboration with Brescia mechanical cluster, cultural shift, positive business cycle
1976-1987	Continued growth		Cost leadership	New fashion turn
1988-2016	Stabilization		Cost leadership, product diversification	Global competition

A pattern of 'stabilisation'

The period 1990-2000 precludes the cluster imminent crisis of 2008, and, in this regard, it reflects the typical features of the maturation and decline stages of the cluster life cycle. With a steady decline in hosiery demand and the consolidation of international competitors, globalisation progressively became the main external triggering factor shaping the development of the cluster. However, we observe that firms exit is mainly accompanied by a process of vertical integration, with a slight increase in employment (only till the early 2000s), which further suggest a process of stabilisation rather than decline (Martin and Sunley, 2011). Moreover, the largest firms continued to innovate by following the tendencies towards related diversification already started in the previous period. In last years of the period analysed (2000-2016), a more pronounced though still feeble diversification of process started to take place. Some of the largest companies managed to enter the high-end markets of haute couture or diversified in small niches such as medical hosiery (e.g. *Calzificio Bellafonte*). In particular the medical hosiery niched grew significantly, and recently performed better than traditional knitwear, increasing its share to more than 15% of cluster total turnover. Leader companies such as *Golden Lady*, *Pompea* and *Calzedonia*⁸ increased their turnover and size by expanding their product range, and by establishing their own distribution channels via franchising and own retail stores⁹. Other firms specialised to become leader in niche markets, such as *Fulgar*, which became leader in the production of fiber threads employed in the textile sector. Companies diversified also in terms of export markets. Besides traditional export areas (e.g. France, Germany, UK), they entered promising markets, such as Russian Federation, Balkan and Middle East countries.

After the general crisis of the years 2007-2014, the cluster has shown some signs of recovery. It can be argued that the it entered what Martin and Sunley calls a 'stabilization trajectory' (2011: 1313-1314). It is yet to be seen how and if this phase will last for long and which triggering factors, either endogenous (e.g. firm diversification) or exogenous (e.g. national policies, globalisation, sectoral crisis) will affect its next evolution.

However in the latest period of crisis some developments can be noticed, which may possibly represent new triggering events and contribute to the further development of the cluster. First, several new ethnic based entrepreneurial ventures have been founded in the cluster. These activities are mainly founded by the local Chinese community, which is very active in the hosiery sector. This development is highly controversial, since many of these small workshops have made use of off-the-book workers, also adopting illegal working practices (see La7.it 14/02/2014 and Gazzetta di

⁸ These companies, though located in the neighbouring province of Verona, originated from the Castel Goffredo district.

⁹ For example *Calzedonia* has more than 2000 own brand stores in more than 20 countries.

Mantova 30/09/2017). However, if changing they could possibly contribute to the resilience of the cluster. The second example concerns the acquisition of related businesses by leading firms (see *Gazzetta di Mantova* 08/04/2017). Although this process of diversification is not new, it may strengthen the emergence of a new related sector in the cluster, so reducing the dependence on a single product (i.e. women hosiery). Third, new forms of cooperation are taking place in the cluster, also in reaction to the 2008 crisis. A case in point is the creation of a cooperative by former workers of a failed hosiery firm. In such a case the local stakeholders (e.g. trade unions, local government, business associations) collaborated to create new working opportunities and experiment with unusual form of entrepreneurship in this cluster (Masotto and Feudatari, 2016). Though this case was prompted by necessity, it can signal the emergence in the cluster of a renewed trust based collaboration environment.

Overall, the above developments are very recent and do not suggest yet a process of reorientation or renewal, but certainly they show that the cluster and its members are undergoing changes, which will lead to a new and possibly resilient path of development.

6. Conclusion

We have investigated the evolution of a traditional industrial cluster in Italy along its long term historical development. The analysis allowed us to identify and characterise its main phases of development, including its antecedents, and the triggering factors behind each of these phases. By doing so we can show that a variety of factors, both external and internal to the cluster, have contributed to its emergence and evolution. From a theoretical perspective, our findings indicate that the cluster development is not fully predictable and linear as suggested by the CLC framework, it rather adapts to the changes in the external environment or in response to internal challenges. In line with the recent reappraisal of CLC approaches, our case study provides additional evidence proving that clusters behave as a self-organizing complex system (Martin, 2012). It also supports the idea that ‘external relations are integral part of cluster dynamics’ (Fornahl et al., 2015, p. 1927).

The cluster emerged as consequence of the failure of a dominant firm in the region, i.e. Noemi, which span out the firms that will later populate the cluster. The spin-off development followed a typical evolutionary trajectory, in which new firms specialise in the same or related activities of the parent and localise in close proximity (Klepper, 2007). However, contingent factors at different scale influenced this development. The emergence of Noemi was far from a pure chance event: the local and national political context, along with the strategic action of its key founder - i.e. Delfino Eoli -, were crucial in making this event to happen. Lately the cluster was shaped by internal mechanisms of co-evolution between firm strategies and policy intervention, which for example

helped local companies to overcome the crisis of the 1970s and enter into a new phase of growth. In more recent times, the expected decline of the cluster was instead followed by a stabilization phase. In line with Martin (2012), we observe a decrease in size, but not a process of rigidification and rapid decline. The cluster is keeping its main identity and specialism, being its core product still women hosiery. However, the cluster is also undergoing some changes. The product diversification process which was initiated by large firms contributed to re-focus their activities and target new markets. This latter evolution is far from setting up a clear path of reorientation. If successful this pattern of change will unfold slowly and become fully apparent in the long term, depending also on how external forces will impact on the individual strategies of firms. This unforeseeable path of development however further indicates that a complex adaptive cycle approach proves to be a useful framework of analysis to unravel the evolution of clusters. The study shows that cluster dynamics is driven by a variety of triggering factors, that play a role at different stages of the life cycle and as shown elsewhere does not lead to a determinate pattern of development (see Belussi and Sedita, 2009). The analysis of the triggers supports the argument that clusters are not isolated entities, instead their internal dynamics is shaped by the external environment (Martin and Sunley, 2011). Overall, the case study shows in line with other recent studies (Trippel et al. 2015; Santner and Fornahl, 2014) that a multiscale approach is needed to unveil the different factors behind cluster evolution.

This work is not expected from limitations and potential drawbacks. As other research based on case studies its implication, in particular on the policy side, need to be taken with caution. It is indeed to large extent a peculiar case strongly grounded in a historically specific context. Nevertheless, it owns also elements of similarities with other experiences, at least if compared with mature industrial clusters based in advanced manufacturing areas in Europe. Its organisational structure is not dissimilar from other typical neo-marshallian districts in Italy and elsewhere, and it followed a similar trend towards concentration, upgrading and internationalisation district (Rabellotti et al., 2009).

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